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The Editor's notes are marked (Ed.).

FIRST PART. ORIGINAL ARTICLES

Forestry in Sweden

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1. AREA AND VALUE OF THE FORESTS. — Without counting the lakes and water-courses, Sweden has an area of over 101 million acres; about 10 million of these acres are occupied by cultivated land, gardens and buildings, about 84 million are uncultivated. This last area may be subdivided as follows:

wooded land above the higher limit of coniferous trees, about	17 300 000 acres
non-wooded land (peat bogs, marshes, mountains, heath, burnt forests, land cleared of trees and not replanted), about	17 200 000 acres
cleared land	55 641 576 acres

or about 54 % of the total area of Sweden.

Of all the European countries, Finland alone has a greater proportion of wooded land than Sweden. The proportion for the whole of Europe is 33 %, western Europe 25 % only. In Sweden there are 905 acres of forest per 100 inhabitants, that is to say, more than in any other country in Europe except Finland; the corresponding figures for the whole of Europe and for western Europe are 183 and 91 acres respectively. At the time the estimation of the national wealth in 1908, the value of the Swedish forests, including that of the soil was estimated as follows:

State forests	230 430 000 crowns (1)
Other public forests	79 104 000 "
Private forests	1 247 651 000 "
Total value	1 557 184 000 crowns

(1) *Sollarsen (Krona) = 18 1/2 d. at par*

This estimation includes neither the value of the peat-bogs, nor that of non-wooded land, which are respectively 5 131 795 and 13 800 000 crowns or 18 931 795 crowns in all. It is very probable that, during the period 1908-19, all these values have increased greatly.

II. FOREST REGIONS. — By reason of its great differences in latitude and altitude, Sweden includes many different vegetation zones determined by the various climatic conditions.

The high mountain district, or high mountain heath, comprises the bare of forest, includes the highest and most northern parts of the kingdom. It runs along the western frontier till it reaches, in the south, a latitude of about 62 degrees.

To the east of this short district, and almost parallel with it, is that of the birch woods, which form a band about 19 miles wide in the north, and rather narrower in the south. To the south it goes a little beyond the preceding region; on the other hand, it encroaches upon some of the heights of the following region. The most common tree is the birch (*Betula odorata subalpina*), which, together with the aspen (*Populus tremula*) and mountain ash (*Sorbus Aucuparia*), forms sparse, low woods, at present only of indirect importance to forestry, as they protect the neighbouring pine forests against the mountain winds.

Below the birch region are the woods of coniferae. These may be divided into northern and southern halves, separated by the northern limit of the oak, which, after crossing Sweden in a NE-SW direction, from the mouth of the river I Jungan (Gulf of Bothnia) to the lake Wenner, runs along the lake in a northerly direction, and finally crosses the Norwegian frontier in the north-west of the Province of Wernland. The greater part of the region of coniferous trees is covered with Scotch fir (*Pinus sylvestris*) and spruce (*Picea excelsa*), either in mixed plantations, often including a few aspen and birch, or else in separate plantations, which sometimes include these two deciduous trees.

Although these, as well as other deciduous trees, are gradually attracting more and more attention, the two coniferous trees mentioned are, for Swedish forestry, by far the most important, and form, in the region described, the largest forests in Sweden, occupying the first place in national economy. Systematic forestry, more or less developed, is now practised in the accessible northern parts of the country, as well as in the southern parts which are better adapted to cultivation. Only in rare cases in the centre and the north of Norrland are there still forests in which hardly a tree has been felled. There the pine usually predominates in dry poor soils, whereas spruce becomes more and more common as the soil increases in moisture and richness. Most of the plantations have sprung up after forest fires and are of a very old age; regeneration is mostly on a very small scale. On heaths where there are pines, the trees are usually grouped round stumps and fallen crowns, or under the shade of trees which are still standing. Growth is slow in the old plantations. Very often the trees cannot utilise the excess of atmospheric precipitation, with the result that muck is formed. The younger and thicker plantations are stronger and often show good growth.

Deciduous trees, such as the oak (*Quercus pedunculata* and *Q. sessiliflora*), the ash (*Fagus excelsior*), the alder (*Alnus glutinosa*), etc., which were formerly very common in the forests of the coniferous region, have had to give way more and more to agriculture and to plantations of conifers.

The same may be said of the region bordering on that of the beech, which occupies the east and south-west of Sweden. There is, indeed, no distinct boundary between this region and that of the coniferous trees, although the northern boundary of the beech coincides with the original southern boundary of the spruce, which has been artificially introduced into the beech region often to the detriment of the latter, which was the original principal tree found there.

In this region, besides the beech (*Fagus sylvatica*) and the deciduous trees also found in the coniferous region, there are the elm (*Ulmus montana*) and the hornbeam (*Carpinus*).

Where coniferous trees are concerned, the Scotch fir grows wild, whereas the dwarf pine (*Pinus montana*) has been introduced in poor soils of shifting sand, as well as certain species of the genera *Larix*, *Abies* and *Pseudotsuga* in suitable soils.

Both in the region of the beech and in the south-west of the southern coniferous region are heaths (*Calluna vulgaris*) entirely, or almost entirely, devoid of trees, occupying out 445 000 acres. Previously these were much larger, but practically all the parts coming to the State have been planted with trees, as well as a good many of those lately owned, and it is easy to foretell that, before very long, they will all be similarly planted.

111. **FOREST ADMINISTRATION.** — 1) **HISTORICAL.** — In the most recent times all Sweden was one vast forest. Then, as agriculture progressed and rights of proprietorship developed, the peasants, the lords and the church joined as theirs the forests nearest to the cultivated land. As for the other large forests, they were generally considered as the common property of the inhabitants of the districts or provinces in which they were situated; it was, however, possible for members of a community to obtain certain specified parts of these forests subject to conditions laid down by the most ancient provincial laws of Sweden, drawn up during the 13th. and 14th. centuries. During the 16th. century, the kings seized a large part of the lands belonging to the Church and the common forests of the provinces, as well as the immense stretch of uncultivated forest land in the heart of Norrland.

In the 19th. century an important economic change occurred. Whereas, previously, the lands were assigned to civil and military officials and to churchmen as official residences taking a certain income which took the place of payment in kind, these officials were henceforth paid directly by the Treasury, and the State from the middle of that century gradually claimed the estates that they might be leased out. The forests adjoining these estates were separated and included in the State forest land, of which they form the larger part in central and western Sweden. Of the country estates assigned to them, churchmen have only retained the manor as official residence, the rest being utilised by the State in the manner described.

The kings gave large forest estates to the universities, schools and hospitals, which still possess them, though partly under State control. In order to help their development, large stretches of woodland had also been conceded to the mining and wood industries; those belonging to the mines have mostly passed into the hand of private individuals, the rest have either been taken back by the State or placed under its control; those belonging to the wood industry have either already been reclaimed by the donor, or will be so during the next few years.

In order to encourage colonisation in Norrland, the farmers were granted large stretches of woodland, once they had cleared and cultivated a certain area, and the State kept the rest. Nevertheless, there are still in the "Län" (provinces) of Norrbotten and Westerbotten, immense tracts which are still uncolonised, and where the farmers are still required to clear the land, but under rather different conditions.

During the first half of the 19th. century the State made large grants of forests to private individuals, especially in central and southern Sweden. According to the liberal economic ideas in vogue, the State and communities were considered incapable of administering lands properly, and it was decided that the greater part of the State forests should either be given away or sold very cheaply. But, in the middle of the century, before this system had been well developed, there occurred a continual rise in the price of wood, which caused such great forest speculation that fears were entertained for their existence. It then seemed certain that the preservation and continuous yield of the forests were best assured by the system of collective property, and it was decided that the State and communal forests should not be disposed of. As a result of this decision, from 1860 onwards, practically no concessions were made, with the exception of those intended to encourage the colonisation of Norrland, the condi-

tions of which, however, were altered; thus, the State reserves to itself the right of control over the forests ceded to farmers during this period, and also over the forests ceded previously in those cases where the conditions laid down for clearing have not been fulfilled. Moreover, in some districts, the farmers have been required to transform a specified fraction of the woodland due to each estate into common forests, which have been put under State control.

The forestry policy thus applied has led to the formation of two large groups of forests differently administered: *public forests* and *private forests*.

2) PUBLIC FORESTS. — At the end of 1914, these covered an area of 22 150 233 acres, not counting about 12 849 720 acres above the limit of coniferous trees in the districts ("Län") of Norrbotten and Westerbotten which are not yet divided between the State and private holders.

A) STATE FORESTS. — Forests, the income from which goes to the State or *State forests properly speaking* cover an area of 14 932 140 acres, the rest 7 218 093 acres, being composed of public forests, the working of which is either undertaken or controlled by the State, but the profits from which go to the communities (towns, "harade" (districts), parishes, etc.), churchmen, private owners, or endowed institutes.

The area of these State forests increases every year: 1) by the addition of certain large land of the "Län" of Westerbotten and Norrbotten, which cannot be ceded to private holders; 2) the reclaiming of forests conceded to saw-mills; 3) by purchase, especially in central and southern Sweden. From 1910 to the end of 1914, there was an increase of 737 906 acres during the period 1875-1914 the State bought 962 251 acres at a cost of 28 426 786 crowns.

The greater part of the State forests are in the north and centre of Norrland. As the soil of these forests is but slightly productive, they do not yield such a large profit as might be expected judging from their immense area. These profits are also diminished by their distance from means of communication (especially waterways), from the coast and from cultivated districts, which increase the expense of felling and transport. Nevertheless, the expenditure and receipts of the State forests have increased rapidly and continually, as is shown by the figures of 1890 to 1914.

	1890	1900	1914
Gross receipts	3 190 426 crowns	8 318 927 crowns	17 256 122 crowns
Expenditure	947 883 "	1 851 284 "	6 287 620 "
<i>Net receipts</i>	<i>2 242 542 crowns</i>	<i>6 467 643 crowns</i>	<i>10 968 502 crowns</i>

B) PUBLIC FORESTS OTHER THAN STATE ONES. — These may be subdivided into two groups: — a) *Forests conceded for a specific purpose*; b) *Forests belonging to communities*.

a) *Forests conceded for a specific purpose*. — The most important of these are the Church land, which number about 2539 and cover an area of 951 540 acres in all parts of Sweden.

The annual yield of wood is utilised as follows: one part is used for the upkeep and heating of the vicarage; another part is used for the building and upkeep of farms and churches, the rest is sold, and the amount realised, after deduction of expenses incurred, is usually paid in to endowments used for the payment of ecclesiastics.

To this group also belong the forests conceded to: 1) hospitals; 2) churches and other official institutions; 3) certain mines and saw-mills. The area of these forests is 87 528, 517 and 1 107 750 acres respectively. Official institutions and mines have a permanent right to the forests conceded to them, and to the income derived therefrom, but the forests are either

owned or controlled by the State. All the forests conceded to saw-mills will have reverted to the State by 1918.

In this group may also be included the land conceded to the Lapps as pasture for reindeer, the mountains of the province of Jemtland, and the forests of the Norrland colonists. The reindeer pasture land covers an area of 247 237 360 acres, only 24 868 327 acres of which are wooded. The income derived from it goes to an endowment fund for the encouragement of reindeer breeding. The forests of the colonies (whose origin and aim have been described above) cover 25 068 352 acres and are under State supervision. The entire income derived from them goes to the colonists.

b) *Forests belonging to communities.* — These are forests owned in common by the landowners of a "härad" (district), a parish or a town.

In the parts of Sweden which have been cultivated longest, that is to say, in the provinces of Lake Mälaren, and also in Östergötland and Westergötland, the forests of the "härad" and the towns cover a total area of 244 794 acres. They have to be worked in accordance with regulations laid down by the State Department of Forestry. From the profits yielded by them have to be deducted, in the first place, the cost of administration, replanting, clearing, etc. The remainder is employed as follows: in the case of towns they are paid into the municipal funds, in the case of the "härad", they are divided among those interested, after the wood required for public buildings has been deducted.

As has been already said, there are, in certain parishes of Norrland and Dalecarlia certain forests belonging to the landowners of the parish but administered and supervised by the State. They cover 1382 830 acres and yield large profits, which go entirely to the parish, thus largely supplying the needs of the landowners, diminishing, or even doing away with the necessity of taxes, besides allowing the formation of substantial funds destined to meet the requirements of each parish.

The working of the public forests and the State agricultural estates is directed by a central office — the Royal Estate Office, which controls both forestry and hunting. Since the beginning of the year 1916 this office has working under it, 2 conservators, 118 rangers (forest inspectors), 11 forestry engineers and assistant forestry engineers, 7 directors of forestry schools, all of whom take part in administration and control.

The circuit of each conservator includes from 8 to 11 districts, that of a ranger forms a canton. The duty of the forestry engineers is to apply the laws of forestry throughout the "Län" of Norrbotten and of Westerhotten, to the east of Lapland. Besides these chief officials, there are large number of apprentices who help with the administration and management. At the beginning of 1913 these apprentices numbered 220, but many of them were at the same time in the service of private people.

Each canton is divided into many sections, directed and supervised by a forest-guard. At the present time there are 479 such forest guards besides 27 "tillsyningsmän" (towerlookers) and 80 "kronoskötare" (keepers of the Crown forests), who are considered almost as the equals of the forest guards. There is also a large number of keepers and assistant towerlookers.

3) *PRIVATE FORESTS.* — These are by far the largest, the most productive and the best situated of the Swedish forests. In the centre and south of the country they belong to more or less large estates. In the forest districts of the north, bordering on the large lakes Mälaren, Hjälmaren, Wetter and Wenner, and called "Bergslagerne" (mining lands), a large part of the forests is in the hands of societies engaged in the mining or timber industries.

In northern Sweden (Norland and Dalecarlie) the forests used to belong either to the State or to the peasants. From 1840 onwards, the flourishing timber industry began to buy the property of the peasants, and these purchases increased to such an extent that, in 1907, industrial societies possessed not less than 36.4 % of the land, and even 59.8 % in the Gävleborg district. The social danger of such a development of industrial companies was then understood, and, from that year, they were forbidden to buy land.

These companies often limited themselves to the purchase of the rights of felling, up to a certain minimum for a certain number of years (usually 50), the ground remaining the property of the peasants. This system, however, completely prevented the preservation of the forests, and, as there were continual disputes between the owners of the land and the buyers of the trees, contracts of this kind for a period exceeding five years were forbidden.

The owners of private forests, especially the peasants, have not always managed their forests in the most satisfactory manner; usually the trees have been felled to an extent far exceeding that justified by their annual growth, so that the State has been obliged to intervene in the management of private forests by a series of legislative measures. Thus the laws passed in 1907 have very largely contributed to the better management of private forests by forming in each "Län" (except those of Westerbotten and Norbotten) a "Commission of Forest Management", with a staff of conservators and "Län" rangers, whose duties are to distribute, free of charge or at a low cost, forest plants and seeds, to give advice on forestry and drainage works, to distribute publications on forestry, etc.

IV. MANAGEMENT OF THE FORESTS. — It is obvious that, in a country varying as much as Sweden, forestry must develop very differently according to the interest of the owner of the forest in rational management, the more or less favourable climate of the various districts, the possibility of selling timber at an advantageous price, etc.

1) **HISTORICAL.** — Already in the 18th. century measures were proposed (by Linnaeus amongst others) for the improvement of forest management, and the State began to plant trees in the stretches of moving sands in south Sweden, partly to prevent the damage caused by these sands, but also partly to obtain wood. Before this date the State had tried, by means of various measures and decrees, to encourage the upkeep and replanting of the oak-woods in order to meet the requirements of shipbuilding, and similar attempts were made till the middle of the 19th. century.

It was only after 1860 that all the forests either owned or controlled by the State were subjected to a systematic management based on scientific principles which aimed at obtaining continuously the highest yields. This has been continued ever since, observing, at the same time, the best measures from a point of view of both prudence and preservation. For this reason the amount of wood cut each year has generally been less than the annual growth. At the same time, as in many other countries, the importance of thinning was not recognised till the beginning of the 20th. century. On the other hand, on land which has been cleared, or which has not had woods for a considerable time, forestry has been practised with the greatest care.

The management of many of the private forests of central and southern Sweden was improved almost simultaneously with that of the State forests, often under the direction of foreign foresters, chiefly Danish and German. But, on the whole, it is only during the last 25 years that any real improvement of private forests has occurred.

On the other hand, there are always, in the higher parts of Sweden, districts where the severe climate, the difficulties of utilising the wood economically and the sparse population make it impossible to cover the expenses which would be entailed by an improved system of management.

As has been said above, the large majority of Swedish forests are composed of pines and spruce; deciduous trees only cover a relatively small area and are of little economic importance.

the following information, therefore, refers essentially to the management of forests of coniferous trees.

2) AFFORESTATION. — The methods employed for the afforestation of lands which have been cleared or not planted for a long time, and for the improvement of natural regeneration, are very varied, but they might all be facilitated by the removal of the twigs, branches and crowns of trees left on the ground after clearing.

In order to do this, these remains are collected into heaps a yard high and a yard wide, or be into stacks, and, generally, burnt. Especially on land covered with a high, thick growth which threatens to choke the young plants, the remains are often set alight without being collected. In this case care must be taken to ascertain that, on the one hand, the twigs and branches are dry enough to burn, and, on the other hand, that the ground is not dry enough to suffer loss of humus through burning. For these reasons this operation is usually carried out at night in early spring.

In the snowy Norrland, and on pasture land, the remains from clearing are often left on the ground as they protect the plants from damage caused by snow as well as from the teeth and feet of animals. Some of the twigs are often spread over very dry and poor soils, thus not only decreasing evaporation, but, eventually, by their decomposition, contributing a considerable amount of food-elements.

Where self-sowing is relied on, the ground is prepared by hand or horse hoeing before the seeds fall. If self-sowing cannot be relied on the ground is artificially sown or planted.

Especially in the case of pines reproduction only succeeds with local seed, so that the cones are collected in the district. The Forest Administration, the Commission for the Preservation of Forests, and also private people, have erected establishments for extracting the seed from the cones collected, and many use the most recently perfected methods.

For planting seeds, holes are usually dug 6 × 6 inches to 12 × 12 inches square, and 2 to 4 inches deep, at regular intervals of from 1 to 2 yards; the largest are made where vegetation is thick (heather), the smallest, where it is more sparse (heather and pines). In each hole are sown from 8 to 20 seeds, according to their quality and the favourable or unfavourable conditions at the time of germination and sprouting. Sometimes the holes are made of a long rectangular shape 2 × 16 inches; this affords a better protection against the teeth and feet of animals, and against raising caused by frost.

For pines and spruce it is usually necessary to use from 0.15 to 0.9 lbs. per acre, and the total cost of sowing varies from 8 to 20 crowns per acre.

Sowing broadcast and sowing in lines have also been tried, but, as they do not give better results than sowing in holes, and are much more expensive, they have hardly been adopted.

As sowing in holes, when properly carried out, gives very satisfactory plantations and, at the same time, is cheap, it is usually preferred to planting, which is more expensive. reference is, however, given to planting: on dry ground exposed to the sun and wind, where vegetation is very thick, or where there is danger that the young seedlings may be replaced by frost. On the other hand, planting is also practised to improve insufficient self-sowing or artificial sowing which has done badly, and to propagate spruce in the north and the south of Sweden.

Nearly all the planting methods common in central Europe and in France have been tried in Sweden, and, as many of them were found suitable, it was unnecessary to experiment with special methods for Sweden. Pines are usually put in the ground when 2 or 3 years old, spruce when 2, 3 or 4 years old; these latter are generally replanted when 2 years old.

The cost of plantation varies very considerably, and depends chiefly on the method employed, the state of the plants, and the number of stones in the ground. Thus, given the most expensive methods, old plants and stony soil, the expenses may amount to 32 to 40 crowns per acre.

On the other hand, with less costly methods, young plants and an average soil, the expenses do not exceed 12 to 20 crowns per acre.

In order to encourage afforestation the Commission for the Preservation of Forests gives, free of charge, or at a minimum price, large quantities of seed and plants to both large and small forest estates.

Moreover, very considerable afforestation work is being carried out without the collaboration of the commissions mentioned above, especially in the large private forests and the State forests. In the latter, in the year 1914, 4094 acres were planted, mostly after complete clearing.

Especially in the north of Sweden there are large stretches of land where the moisture is too great to allow the trees to grow normally. Here drainage is being carried out, with or without afforestation, and often affects the marshes and peat-bogs. Thousands of acres are thus improved or reclaimed for afforestation every year.

3) UPKEEP OF THE PLANTATIONS. — In intensive forestry the growth of plantations of a certain size is facilitated by removing undesirable self-sown trees, such as birch, alder, aspen, etc., by cutting the excessively luxuriant growth which covers the ground, by clearing the plantations by the removal of plants harmful to their neighbours, and which, at an early date show unsatisfactory progress. Usually, however, the plantations receive no attention till the trees are big enough to be sold, that is to say, for 20 to 40 years in the centre and south of Sweden, and for 50 to 70 years in the north. In the colder parts of Norrland it is usual to wait longer, so long in fact, that no attention gives any economic advantage.

The wood is generally sold in planks or boards. As the value of the trunks, per unit of volume, increases in proportion as they are thicker and less covered with branches, a system of thinning, aiming at producing this result, is adopted. At first the young plantations are thinned very little, rather, they are kept thick, so as to prevent the sunlight from reaching the lower parts of the tree; this causes and hastens the fall of the branches. When the trees are free from branches to a height of about 19 to 32 feet, more rigorous thinning is practised, all dead, sick, forked and twisted trees being removed, as well as those detrimental to the crown of their neighbours. The trees which remain thus have more space, more light and more food, and it is possible for them to increase both their diameter and their crown (this last point is very important, for regeneration for example.) During this operation the trees are distributed as uniformly as possible; in intensive cultivation, 120 to 160 trees per acre to be removed are marked in colour.

In forests where the soil is good thinning is carried out so that the ends of the branches of the trees do not touch; this greatly increases the growth in diameter and strengthens the crown. In poor soils, however, such vigorous thinning does not give the same advantages, as the increase of light does not cause the trees to increase in diameter, moreover, the soil is apt to suffer detrimental modifications as the result of this increase of light.

4) CLEARING AND REGENERATION. — In the centre and the south of Sweden, as well as in the more accessible parts of Norrland, clearing and regeneration are now carried out by means of either complete clear-felling, or felling, leaving seed-bearing trees.

By the first method all the trees on the area to be regenerated are felled. By the second method 20 to 60 stock plants are left per acre. These trees serve both to sow and protect the soil, and are also a protection to the young trees.

The first method is only used if there are suitable seed-bearing trees, or if one kind of wood is to be replaced by another. Thus the spruce, whose superficial root system makes it

able to be uprooted in storms, and which is consequently unsuitable as a seed-bearing tree, is generally clear-felled especially when it forms pure stands.

On the other hand clear-felling leaving seed-bearing trees is the more usual method in Sweden in pure stands of pines and in mixed forests of pine and spruce. This method has obvious advantages, especially when, as a result of suitable thinning, trees have become sufficiently resistant to storms and have developed large crowns, capable of good fructification. The fact that regeneration is only carried out with really good trees assures transmission of the best qualities.

When clear-felling in Sweden it is of little importance to take into account the direction of the prevailing wind, as is done in central Europe, because there are other means of preventing damage done by wind. In Sweden, the soil being nearly always stony, the roots become very solidly fixed in the ground, and the forests thus become particularly resistant to storms. In recent years it has been shown that there is a great advantage in felling late, so that the atmospheric precipitation and the poor heat from the sun, may be utilised to the best possible advantage, especially in Norrland.

With the complete clear-felling method, artificial regeneration is practised. With the clearing method leaving stock trees, regeneration is carried out, either by self-sowing (the soil not being prepared beforehand), or, if there is a lack of seeds, by artificial sowing.

The methods used in the coniferous forests of France and south-west Germany—selection, cutting, regeneration by groups, strip-felling—have been strongly recommended in Sweden of late years, but are used practically only in small forests, from which a great variety of timber is desired, or which serve as a protection against mountain winds, moving sands, etc., near forests, fields, villages or towns.

Unorganised felling.—This method is used almost exclusively in the less accessible parts of northern Sweden when the consideration in choosing trees for felling is not regeneration but the utility of the trunks for a certain purpose. Even in this case good regeneration is aimed at as far as possible. This extensive selection is called "size-felling", because only those trees are cut which are large enough to be used profitably. Previously this method was very largely practised because it was thought that it allowed the trees which were left standing to reach maximum growth before felling, and, by their seeds, to form a new plantation in the gaps by clearing. These results were obtained up to a certain point in some cases, but frequently the trees left did not utilise the free space to increase their growth to any considerable extent, often they dried up (especially the spruce). Moreover the regeneration which had been expected was, more often than not, very slight, and even nil. Many places were invaded by deciduous trees which established itself firmly in the poor soils, where it only gives an inadequate yield and prevents the growth of pines, which are less exacting and would do better there. The result is that, in numerous forests treated by this method, growth was considerably diminished in many years. As the possibility of selling increases, and new methods of reproduction are tried in these districts are tested, these plantations are replaced by younger ones of better quality.

5. PASTURE. — In order to utilise the abundant grass of the valleys, horses, cattle, sheep and goats are turned out to pasture on it, and these animals often wander about without any supervision. These animals, especially sheep and the goats, do much harm to the plantations by trampling and eating the plants.

This, combined with the once common practice of removing the young coniferæ which most shade so as to improve the growth of the grass, has resulted in the fact that, in those districts nearest to farms, coniferæ have often been replaced by birch, which requires light. Due to its rapid growth when young and its capacity of frequently giving off new shoots from the same trunk, the birch stands a good chance of surviving the harm done to it by animals. It is particularly in spring when there is little grass, that animals attack trees. For this

reason laws have been passed limiting grazing at this season, but it is impossible to forbid entirely on account of its real importance for the keeping of cattle by peasants in some part of Sweden. Thus other measures have had to be taken to protect the plantations, for example the young stands are fenced in; when clear-felling, branches are left to impede the entrance of animals, or the animal are prevented from entering. The most appropriate measure, nevertheless, would be to reserve the best grass-land for grazing, and to increase its yield as much as possible. This land might be covered with trees in groups or isolated, but wood production must be looked upon as of secondary importance. Only here should the animals be allowed to graze, so that the forests may be kept free of them.

V. FOREST PRODUCTS. — 1) PRODUCTION OF TIMBER. — It is difficult to estimate the value of the Swedish timber production, for statistics bearing on it are either incomplete or non-existent. Nevertheless, a fairly correct estimate may be formed of the well-kept complete stands. The figures given below may be taken as representing the production of the pine stands during 100 years; they include both the final and intermediate cuttings.

	Best sites cu. feet per acre	Medium sites cu. feet per acre	Inferior sites cu. feet per acre
I. Lapland and Norrbotten.	6433	4285	2143
II. The rest of northern Sweden (including Dalecarlie)	8547	5720	3216
III. South Sweden	10720	7109	4285

The complete, well-kept spruce stands probably give, at an equal age, in Districts II and III, a standing stock slightly greater than that of the pines, and, in the "Län" of Norrbotten and Westerbotten, about an equal volume.

Another question now arises: — what is the average yield of the forests under the present conditions of preservation? It is, of course, below that already mentioned. Thus, forest composed of pines ($2/10$ ths.) and spruce ($7/10$ ths.) on a large estate in central Sweden gave at the age of 100 years: — on good sites, 7506 cubic feet; on medium sites, 5826 cubic feet; on inferior sites, 3810 cubic feet. An estimate made on 2952470 acres of the forests of the "Län" of Wermland (central Sweden) showed the standing stock per acre to be 1077.8 cubic feet, and the annual growth (without bark) to be 31.9 cubic feet.

Repeatedly, for some time past, attempts have been made to calculate the total annual yield of the Swedish forests, taking, as a basis, the estimates of the forests. The results obtained differed greatly, but it may be assumed that, probably, there is an annual yield of 1235 millions of cubic feet.

Attempts have been made to determine whether the annual felling is equal or inferior to the annual growth by comparing the calculated annual yield with the total annual consumption (in the country and exported). Below is an example of the calculation made.

Timber exported in 1911 (unworked timber)	340 169 660 cubic feet
Timber converted to charcoal by the mining industry	211 896 000 " "
Timber of all kinds used in the country (timber, firewood, including the by-products of felling, etc.)	776 952 000 " "
Total annual consumption	1 329 017 660 cubic feet
Total annual production	1 235 000 000 " "
Annual excess of felling over growth	93 957 660 cubic feet

There is, therefore, no need to fear a failure or necessary decrease in the amount of material supplied to the timber trade which is of such great commercial importance.

Sweden. On the one hand, the production of the forests can surely be increased, on the other, it is possible to reduce very considerably the wood requirements of the country. As the means of communication in the north of Sweden increase and improve, greater and greater stretches of woodland may be subjected to rational forestry methods, so that, not only will growth be increased, but it will be possible to utilise trees hitherto unsaleable. The continual rise in the price of wood will necessitate a restriction of its use, which, up to the present, has been excessive. On the other hand, in the manufacture of iron, part of the charcoal used is being gradually replaced by "white-coal" (electricity produced by water-power). These two means of economy will together place a considerable amount of wood at the disposition of the export trade, so that the development of this trade, which has hitherto been so rapid and so advantageous to Sweden, may be assured in the future.

It is very difficult to calculate the total annual production of wood, for no exact data of the requirements of forest owners in fire-wood and timber are available. There is, on the wood tax, a tax calculated in accordance with the value per foot of the standing wood. In 1911, 1912, 1913, this duty was 98, 98.5 and 105.5 *crowns* respectively.

2) SECONDARY PRODUCTS. — Besides wood, the forests give other products, the most important of which are grass and soft fruits.

The grass is generally used as pasture, but there is no basis on which its value may be estimated. The soft fruits, for example, raspberry (*Rubus Idaeus*), blackberry (*Rubus Chamaemorus*), bilberry (*Myrtillus nigra*) and cranberry (*Vaccinium Vitis Idaea*), are used as a food, cranberries and bilberries being also exported. The value of the cranberries exported in 1912 was 1,350,000 *crowns*, and in 1913, 750,000 *crowns*. The cost of picking, which is fairly high, must be deducted from these totals. Bilberries are exported in smaller quantities.

VI. FOREST LAWS. — The most ancient judicial sources of Sweden, the provincial laws, already contained stipulations concerning the *public forests*, which since then, have been the object of abundant legislation.

The management of the *private forests* has been controlled by forest laws which vary greatly according to district, either as a result of historical factors, because of the differences in configuration of the country.

This forest legislation, which dates back to very ancient times, has passed through many varying stages of development, between complete liberty and the most minute official control. The new legislation was applied, in the first place, in the six northern "Län" of Sweden. A royal decree of 1866 laid down, for these districts, the following regulation: "clearing to be carried out from this year onwards or that already carried out which did not satisfy the conditions imposed as to the cession of forests, must be limited as follows: cutting of wood for sale shall only be carried out according to a scheme drawn up by a competent forestry official, and by order of such an official". This law is in force on a great many estates, especially in the "Län" of Norrbotten and Westerbotten, and in the north the "Län" of Kopparberg.

On the other hand, most of the estates of the "Län" of Norrbotten and Westerbotten to the east of the frontier of Lapland, already answered to the above conditions before this decree was published, so that it does not concern them. For them a law has been drawn up regulating the size of the trees to be felled, and containing this regulation: "Those coniferous trees (all living) which have not attained a diameter of at least 7.5 ins. (without the bark) at 16 feet above the surface of the ground, shall not be felled without the authorisation of a competent forestry official". This law has resulted in good care being taken of young and medium aged forests.

In the relatively unimportant islands of Åland and Gotland there are also laws forbidding the felling of trees to be sold, except by the authorization of the forest administration.

The year 1903 is memorable in the history of Swedish forest legislation on account of many laws and statutes, containing new principles, which were drawn up then. Such, for example is the law concerning *protective forests*, which aims at assuring the preservation of the forests required to fix shifting sands or to prevent the degradation of high mountain slopes. Protective forests have been reserved in the high mountains of the "Län" of Jemtland, Westernorland and Kopparberg. All felling in these districts, other than that for domestic purposes, can only be carried out with the authorization of forest officials.

All the above-mentioned laws and statutes place no limit on the felling of wood for domestic use. The quantity of wood felled for this purpose is, however, relatively unimportant in comparison with the enormous quantity which is cut for sale and which, as has already been said, is generally authorized by the forest officials.

In 1903 also, the law concerning the other private forests was passed. This law applies to the land untouched by the preceding laws and statutes, in other words, the greater part of Sweden. This law decrees that felling and cultural operations must not be carried out in a manner which may prejudice regeneration. Whoever carries out these operations in a manner contrary to the conditions laid down by this law has to find means of assuring regeneration. The application of this law is controlled by the "Commissions of Forest Management" and their action whose action is regulated by a royal decree of 1903. The Commissions receive annual grants from the State and from most of the "Landsting" (provincial councils), and the income from the tax of 1.3% on the value of the wood sold throughout the kingdom, with the exception of the "Län" of Norrbotten and Westerboten, and part of that of Kopparberg. The income from this tax, divided by the State amongst the various above-mentioned Commissions, forms the greater part of their funds, which, consequently are largely dependent on the amount of wood cut annually. The income from the 1914 tax, used in 1915, amounted to 982 251 crowns and, besides this, the Commissions received grants amounting to 218 761 crowns, that is to say, 1 231 015 crowns in all.

VII. FORESTRY RESEARCH AND INSTRUCTION. — 1) STATE FORESTRY RESEARCH STATION. — This Station was founded in 1901. In 1913 it had an income of 62 400 crowns. In 1915 it moved into large premises close to the Experimentalfältet near Stockholm. This Station, which includes a forestry department and a scientific department, is under the same management as the High School for Forestry. The results of its work are published in the "Communications of the State Forestry Research Station", of which up to 1916, 12 volumes amounting to 2500 pages had appeared. It also publishes pamphlets or short papers on special subjects.

In 1916, a special sub-department was founded to study certain questions bearing on regeneration in the forests of Norrland. The work is to extend over 15 years, and the expenses are estimated at 230 000 crowns.

2) FORESTRY INSTRUCTION. — Up till quite recently the State forestry schools were the *Institute of Forestry*, founded in 1828 to train administrative officials, and the *Schools of Forestry*, where supervisors were trained.

Later, in 1912, it was decided to change the Institute of Forestry into the *High School for Forestry*, which, besides training administrative officials, should also study the development of rational forestry science. It holds: — a) a "Högskola" (rangers or conservators) course, preceded by a preparatory course; b) a course for training agents for private forestry (conservators).

In order to be admitted to the "Högskola" course it is necessary to hold the certificate given by the secondary technical schools and the efficiency certificate given after the preparatory course. The length of time required for the studies is 9 months for the preparatory course and 2 ½ years for the actual course of the High School of Forestry.

On leaving, the students may enter the State service after doing from 6 months to 1 year of practical work, providing they show sufficient knowledge in all the branches.

In order to be admitted to the course for private forest agents, it is necessary to have a practical knowledge corresponding to that required for the leaving certificate of the secondary technical schools, and to have done at least 22 months practical work. The course lasts from 1 to 1½ years.

As has already been said, the High School of Forestry is under the same Management Committee as the State Forest Research Station. The head of the State Estate Office is a permanent member of this Committee.

The *Forestry Schools*, seven in number, are divided among the various districts of Sweden. Each is administered by a director, aided by a forest guard, who also controls the State forests set apart for the instruction of students.

Each school usually has 20 pupils, all of whom receive free instruction and board, and about half of whom also hold studentships of 250 *crowns*.

The courses, which last from the 1st. October to the 15th. September of the following year, aim at giving the students : — a) the scientific knowledge which forms the basis of forestry ; b) skill in the most important forest work ; c) the ability to direct this work.

SECOND PART.
ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

- 988 - Are *Anopheles* of Non-Marshy Districts Capable of Transmitting Malaria?
ROUBAUD, E., in *Comptes Rendus des Séances de l'Académie des Sciences*, Vol. 165, No. 1,
pp. 401-403, Paris, September 17, 1917.

In spite of the continuous presence of *Anopheles maculipennis* in certain reclaimed districts of France, such as the Dombes, Sologne, etc., which were previously marshy, malaria has not reappeared to any marked extent. This fact has given rise to the supposition that the extinction of the disease may be connected with a sort of natural immunity of the mosquito concerned. GRASSI, SCHAUDINN, and other workers admit the existence of species of mosquitoes naturally immune to malarial infection, which appear to have played an important part in the gradual disappearance of the endemic. It has even been suggested that good results might be obtained by the artificial distribution of these species as a malarial prophylactic.

At the Pasteur Institute at Paris patients under treatment for malaria were bitten by perfectly healthy *Anopheles* taken in the town, and it was proved that these mosquitoes were thus infected. The experiments were carried out with: 1) *Plasmodium vivax* Gr. and Fel. or var. *tertianum* Lav. (benign-tertian); 2) *Pl. praecox* Gr. and Fel. or var. *parva* La (malignant-tertian).

The author, who was perfectly healthy, allowed himself to be bitten by one of the infected mosquitoes on the 28th. August. On the 13th. September the fever appeared, preceded a few days previously by exhaustion; the sporozoites (*Plasmodium vivax*) were located in his blood on the 14th. September.

It is seen, therefore, that *Anopheles maculipennis* of the Parisian, non-arshy district, is perfectly capable of transmitting malaria, and is in no way an immune species. It is, indeed, highly improbable that any such species exists.

7. **Poisoning by *Illicium religiosum* Siebold, in the Philippines.** — GUERRERO, L. F., DE LA PAZ, D. and GUERRERO A. L., in the *Philippine Journal of Science*, Vol. XI, Sect. B, No. 5, pp. 203-213, bibliography of 11 publications. Manila, September 1916.

Experiments, carried out by the authors in collaboration with Miss F. A. NICHOLAS in the Department of Pharmacology of the University of the Philippines, showed that the fruit of *Illicium religiosum* is 14 times more toxic to kittens than *Illicium anisatum*; 0.25 gr. of the former per kilogram body weight, injected hypodermically, is the minimal fatal dose for cats. The latter is frequently used as a stomachic and carminative stimulant, and in the preparation of various dishes and drinks. Cases are described among the natives and Chinese, where an infusion of *I. religiosum* fruit, taken as a remedy for cholera and other illnesses, caused violent poisoning, characterised by convulsions followed by exhaustion. One case was fatal in spite of medical care.

This matter is of great importance since, as they cost less, *I. religiosum* fruit are often used as a substitute for *I. anisatum*. A table is given of the different characters of the two fruits.

8. **The Degree of Bolting of Flour in Relation to Healthy Alimentation.** — See No. 1067 of this Review.

CROPS AND CULTIVATION.

9. **Investigations into Soil Efflorescences in Germany.** — FUCHSNER, H., in *Kolloid-Zeitschrift*, Vol. XX, Pt. 5, pp. 209-238 + 17 figs. Dresden, May 1917.

A study was made of the formation of saline efflorescences on the surface of natural substances (sand, peat, clay, kaolin, soils) and artificial material (metasilicic acid, calcium carbonate) by atmospheric action as a result of the evaporation of the water they contain.

The results of the experiments, made with sodium chloride, show that the growth of these efflorescences is greatly influenced by the nature of the soil or other material containing the saline matter. The form and tallness structure of the efflorescences studied does not only depend on the presence of colloidal humic matter, but also on the fineness of the particles. The salt content at which efflorescences start to form is defined as the *coefficient of efflorescence* ("Schwellewert").

The investigation is to be continued in other soils with other salts.

992 - The Absorption of Cations and Anions by Soil. — DE DOMENICIS, A., MAMMANO, G. and DIAPERIA E. (Regia Stazione Chimico-Agraria di Portici, 1914), in *Annali della Regia Scuola Superiore di Agricoltura in Portici*, 2nd. Series, Vol. XIII, p. 26. Portici, 1916.

This paper is an experimental contribution to the problem of the absorption of ions by saline solutions. Three principal questions are examined;

1) The actual behaviour of a certain number of ions of saline solutions. In the first place attempts were made to determine whether all the positive ions are absorbed without distinction. For this purpose metals such as aluminium and iron, of which the absorbant properties of their sesquioxides only were known, were used. It was also sought to determine which negative ions the absorbing power of the soil was inactive. To the end anions such as the nitrous anions of nitrites, the silicic anion of silicate and the carbonic anion of carbonates, were examined.

2) The order in which the cations on the one hand, and the anion on the other, follow each other in relation to absorption.

3) The action of the valency of the ions by reason of its great influence on all the phenomena of absorption; it was clear that this must be present in the special case of soil absorption. Moreover, if it be true that coagulation and absorption are related, it is obvious that the valency must influence the absorption as well as the coagulation. Monovalent, bivalent and trivalent ions were tested for this purpose.

The behaviour of the aluminates was also studied in order to determine whether the action of aluminium is similar to that of nitrogen.

All the experiments were carried out under similar conditions so that an exact comparison of the results could be made. Thus, for the proportions of absorbant soil, the conception of gramme-equivalent ion and gramme-ion allowed comparisons to be made with terms of magnitude which were perfectly similar and comparable, thus furnishing determined and rational means of reference. Moreover, these magnitudes, ions and equivalent must be considered as actual entities which take part in the physico-chemical reactions. The weight of the absorbant, the volume and concentration of the substance to be absorbed, the duration of contact, the temperature, were, therefore, always invariable. On the other hand, in view of the objects of the work, and in accordance with the demands made by it, the nature of the absorbant (soil) and that of the substance to be absorbed (ion of the electrolyte in solution), were varied.

Five different soils were used; chlorides of ammonium, potassium, sodium, calcium, magnesium, aluminium and trivalent iron, were tested for the absorption of the cations. For the absorption of the anions, with the same soils, chloride, nitrate, nitrite, sulphate, carbonate, silicate, mono-acid phosphate and aluminate of sodium were used.

The experiments were carried out as follows:

100 grms. air-dried soil were passed through a 1 mm. sieve, and placed in a litre bottle; 250 cc. of solution corresponding, in the case of decimolar solutions, to 25 milli-molecules (1), and in the case of normal solu-

(1) Millimolecules = thousandths of the molecular weight expressed in grammes (E.).

ms, to 25 milli-equivalents, were added. The bottle was well corked and it in an agitator. After being shaken for 3 $\frac{1}{2}$ hrs. the bottle was removed and left for $\frac{1}{2}$ hr., after which the liquid was decanted over a dry filter. This liquid was used for the determinations, an aliquot part being used and the results being calculated for the whole. The absorption was determined, the variation in concentration of the solution in contact with the soil.

The results obtained showed that the soil absorbs the cations without exception, not one of them proving inactive. Those most largely absorbed were iron and aluminium, the character of whose sesquioxides were unknown. The anions were also absorbed without exception. It is true that, in some cases, the hydrochloric anion (Cl^-) and the nitric anion (O_3^-) showed a negative absorption, but there were, among the anions, absorptions which equalled, and even exceeded, those of the cations.

The absorption of the anions may be interpreted without reference to the conception of insoluble chemical combinations to which the absorption of phosphoric acid had hitherto been referred; they are absorbed by amorphous compounds charged with positive electricity in the same manner the cations are absorbed by amorphous compounds charged with negative electricity.

The valency of the ions absorbed has a special influence on the intensity of absorption. In the case of cations, as in that of anions, the monovalents are less absorbed than the bivalents, and these less so than the trivalent. The order in which the cations on the one hand and the anions on the other follow on each other in relation to absorption is identical for soils; only the general capacity of absorption can vary in different soils. This fact confirms the assumption that, in the absorbant capacity of the soil, the physical character is the decisive factor, and may be explained by the nature of the colloidal substance and of the circulating solution.

1 - **The Humus Content of the Soil as a Guide to Fertility.** - CARR, R. H. (Assistant Professor of Agricultural Chemistry, Purdue University), in *Soil Science*, Vol. III, No. 6, pp. 515-524, fig. 3. Bibliography of 16 publications. New Brunswick, June 1917.

In recent years, there has been a tendency on the part of numerous investigators to question the value of the humus determination in soil fertility work. The writer has been studying the effect of humification of various farm manures, as well as green manures, and has made vegetation tests to aid in estimating availability of plant food contained in the complex plant molecules. He has found that the growing plant cannot directly utilise much of the plant-food contained in other plant products until certain re-arrangements in the molecules have taken place. This is usually brought about by bacterial and weathering agencies cleaving off certain portions, probably in the order of their availability to the growing plant. The object of the present research was to measure the rate of cleavage by determining the percentage present and the rapidity of increase of humus in the soil as measured by its organic matter soluble in 4 per cent. ammonia. The method devised by GRANDEAU and modified by SMITH.

For this purpose, the writer used a clay surface soil which was very

deficient in organic matter. The soil was screened and mixed with different manures (hen manure, sheep manure, pig manure, horse manure, cow manure and steer manure). Green manures (*Vigna caliang*, lucerne, sweet clover, and oat straw) were also used, being applied either whole or divided. The soil, when screened and mixed, was placed in double boxes holding cubic foot each; the boxes were buried 8 ft. apart in a trench, the tops being allowed to project a little above the surface of the ground. The amount of organic manure applied at the same time as the lime, carbonate of lime or dolomite, as the case might be, was equivalent to 1 pound of dry material. The determination of the ammonia-solubility was made at the time the manures were mixed with the soil, and at various subsequent periods. Maize was planted in the boxes containing the green manures (as well as in the other boxes), and the yield was estimated.

The results of the vegetation and humification tests would seem to show that, whenever there is rapid humification of manure, the growth of the plant is greatly stimulated. This is especially noticeable when green manures were rolled under and limed, as compared with disking, or mixing the manures uniformly with the soil. Certain of the manures experimented with, especially steer manure, green lucerne and, to a less extent, cow manure seem to be as soluble in 4 per cent. ammonia when just mixed with the soil as after humification. Horse manure appears to humify slowly, and its plant-food was largely unavailable to maize during the first year, but the humification tests show it becomes more available the second year. It was possible to increase the rate of humification of horse manure in the first year by adding dolomitic limestone. Although there is no apparent relationship between the percentage of ash in humus and the growth of maize the humification and vegetation tests would seem to indicate a rather close relationship between the amount of humus and the growth of maize.

994 - Ammonia-Fixation in Semi-Arid Soils; Researches in the United States.

MACBETH, J. G. (Physiologist, Soil Bacteriology and Plant Nutrition Investigator, Bureau of Plant Industry, U. S. Dept. of Agriculture), in the *Journal of Agricultural Research*, Vol. IX, No. 5, pp. 141-155, 1 diagram, XIV plates. Washington 1917.

These researches, carried out on various semi-arid soils of California and Maryland, have led to the following conclusions:

1) Many sub-soils of semi-arid land can fix large amounts of ammonia, of which a large part cannot be recovered by the usual methods for estimating ammonia in the soil. Even distillation with an excess of caustic alkali does not result in the recovery of all the ammonia in soils of this type.

2) Prolonged boiling with 10% hydrochloric acid extracted nearly all the ammoniacal nitrogen in one of the soils under study, whilst less than 75% was extracted from another soil.

3) The nature of the anion of the ammonium salts used appears to have little or no influence on ammonia-fixation.

4) In semi-arid soils, fixation increases with the depth, to the contrary of what usually happens in damp soils.

- 5) It increases with the concentration of the solutions of ammonium salts used.
- 6) It increases with the temperature.
- 7) It commences very rapidly, then continues slowly for several days.
- 8) Heating a soil to 200° C or more for 6 hours, decreases its power of ammonia-fixation.
- 9) The power of ammonia-fixation is also decreased by the addition of salts of aluminium, iron or potassium before the addition of the ammonium salts, while salts of calcium, magnesium and sodium have little effect in this respect.
- 10) The anions of all these salts appear to be equally without effect in this respect.
- 11) In semi-arid soils, the quantity of calcium dissolved by ammonium chloride increases with the depth, on the contrary to what happens with chlorides of aluminium, sodium or magnesium. There seems to be a relation between the elimination of calcium and ammonia-fixation, but the evidence is too scanty to allow of any precise deductions to be made.

15 - Influence of Crop, Season and Water on the Bacterial Activities of the Soil; Experiments Made in Utah, U. S. A. (1). — GREAVES, J. E., STEWART, R. and HIRST, C. T. (Department of Bacteriology and Chemistry, Utah Experiment Station), in *Journal of Agricultural Research*, Vol. IX, No. 9, pp. 293-341. Bibliography of 66 publications. Washington, D. C., 1917.

It is of the utmost importance that the quality and quantity of plant food rendered available during the season should nicely balance that required by the growing plant, for then we have the maximum yield with the minimum use of soil fertility. Most of the changes which take place in the soil constituents are caused by micro-organisms; the speed with which these transformations take place within a soil is governed, amongst other factors, by the season of the year, the crop, and the water which the soil receives.

The writer carefully examines the literature dealing with the subject, and sets forth the results of his experiments carried out on soil of a sedimentary nature. There were 5 series of 4 plots; one series was fallow, while the others were under lucerne, maize, potatoes and oats respectively. In each of the 5 series, one plot was not irrigated, while the others received a minimum (15 inches), average (25 inches), and maximum (37.5 inches) amount of water, which was applied 5 times in equal quantities. The plots were sampled during the spring (about the middle of April), mid summer (about the end of July), and in the autumn (about October 31 or November 1). The samples were analysed for moisture, nitric nitrogen, number of bacteria developing on synthetic media, and the ammonifying and nitrifying powers.

It was found that during spring and summer the nitric nitrogen is about uniformly distributed throughout the first 6 ft; in soil under lucerne the amount remains relatively small during the different seasons, but is a

(1) See also *R.* September 1917, No. 795.

little larger in autumn than in spring. In this layer the *absolute* amount of nitrates formed increases with the quantity of water supplied. On the other hand, the *relative* quantity of nitrates, that is to say, the amount bearing a relationship to the water supplied, is greatest where only 15 inches of water are given. In the upper layer of the fallow plot and of those under potatoes, oats, and maize respectively, the relationship of nitrate formation to water-supply is exactly the same as in the case of the lucerne plots.

Large quantities of nitric nitrogen disappeared from the fallow soil during the summer months. This is attributed to the growth of bacteria which transform it into protein substances, and not to denitrification.

The larger applications of water carry much of the nitric nitrogen beyond the sphere of action of the plant, and this accounts for the decrease in crop yield, which is often noted when excessive quantities of irrigation water are applied to the soil.

The application of water to a soil depresses the number of organisms which will develop on synthetic agar in lucerne, oats and potato soil, but increases them in fallow. The results obtained with maize are irregular. The ammonifying power of all the soils, except the lucerne, was increased by irrigation. Water increased the nitrifying powers of all the soils, except the oat soil. There was a difference of 2° F. in the temperature of the irrigated and non-irrigated soils. This difference in temperature was perceptible to a depth of 4 ft.

The number of organisms is higher in the cropped than in the fallow plots, and this is probably due to the plant residues left upon the cropped soil.

Naming the soils in order of increasing ammonifying power, we have lucerne, oats, maize, potato and fallow. By naming them in the order of increasing nitrifying power, they are: fallow, maize, oats, lucerne and potato. The lucerne not only feeds closer upon the nitric nitrogen of the soil than do other crops, but it also increases the nitrifying power of the soil. Hence it would deplete the soil of its nitrogen more rapidly where the entire crop is removed than would other crops.

The use of irrigation water, by increasing the bacterial activities of the soil, renders the nitrogen soluble, and where excessive quantities of water are used, much of the nitrogen is washed from the soil, thus unnecessarily depleting the soil of its nitrogen. This in turn gives diminished crop-yield.

996 - Methods for Determining the Reaction of the Soil; Investigations in Denmark

— CHRISTENSEN H. R., in *Tidskrift for Planteavl.*, Vol. 23, pp. 1-83. Bibliography of 3 publications. Copenhagen, 1916.

In previous papers (1) the Author described the results of investigations undertaken to determine the influence of the state of the soil on its reaction and basic quality, and showed this influence to be very complex. He also showed that the determination of the reaction of the soil may form a criterion of its lime requirement. Although the methods used were mainly

(1) See R. 1916, No. 813

qualitative, they permitted a fairly just estimation to be made because, contrary to the requirement of nitrogen, phosphorus and potassium, the lime requirement is not shown by the amount of assimilable nutritive elements in the soil, but represents, rather, a peculiar state of the soil characterised by the presence or absence of certain substances of a specific nature.

Exact *quantitative* methods of determination would, in many cases, give very interesting results, but, for the moment, the Author limits himself to a study of the *qualitative* methods in use up to the present (the testing of acidity with litmus or *Azotobacter* cultures), which show whether the soil does or does not contain the necessary basis substances, although they give but a vague idea of the eventual requirement and reserves of these substances. The practical value of the quantitative determination of the acid or basic quality of a soil in relation to its lime requirement must not be exaggerated, because the liming and marling of soils very poor in lime gives them a sufficient quantity of this base to last for a certain number of years, and, besides, the more complicated and costly the experimental methods are, the less easy is their practical application. On the other hand, results obtained by quantitative methods would doubtless lead to a greater knowledge of the complicated relationships between soil and lime, and might be of great importance in the scientific study of the influence of lime, in various quantities, on the condition and fertility of different soils. Nevertheless, *qualitative* determination is of great importance in the scientific study of the influence of the acidity or alkalinity of the soil on its physical, chemical and biological conditions.

In 1915 the Author studied the *quantitative* determination of the acidity of the soil, and in a second series of investigations compared various methods of the *qualitative* determination of the reaction of the soil in connection with quantitative determinations of the soil's capacity for setting free the acids of various salts.

The results of these investigations show that it is difficult to distinguish the *effective acidity of the soil* from its *capacity for setting acids free*, absorbing (neutralising) basic substances. Most of the methods proposed for the quantitative determination of the acidity of the soil in no wise show its true content in acid-reacting substances (i. e. substances which, in solution, give a hydrogen-ion concentration greater than 10^{-7}), but only its capacity to absorb (neutralise) basic substances, which is due, partly to the presence of acid-reacting substances, partly to the presence of colloids unsaturated with bases, or other substances which, through they have no acid reaction, absorb bases. There is no method which allows a reliable *quantitative* determination of *actual acidity*, although that proposed by ROBINSON and his collaborators, and that of DAIKUHARA with chloride solutions (1) seem, in many cases, to throw valuable light on this subject.

To determine the soil's capacity to absorb bases, BAUMANN and

GULLY's acetate method is preferable to that of TACKER and SUCHTING, not only because it gives more reliable results, very near to the absolute values, but also because it is more rapid.

BAUMANN and GULLY's assertion that there are no free acids in peat moss is probably incorrect, for the Author's investigations show that the capacity to absorb bases, which is characteristic of this type of soil and of others which give an acid reaction to litmus, is always due to the presence of substances with an effective acid reaction. This agrees fairly well with the theory, laid down by the Author in a previous paper, that crude, unseparated peat contains a large proportion of these substances. No more exact is the assertion of BAUMANN and GULLY, supported by RAMAN, that the capacity of a soil to turn neutral litmus solution red does not prove the presence of free acids in the soil, but is only due to the capacity of the soil colloids to liberate the acids of neutral salts. It has been proved that no close relationship exists between a soil's capacity to liberate acids (determined by the calcium acetate method) and its litmus reaction, for many soils which, when tested by this method, show a high capacity for liberating acids, give a neutral, or even slightly alkaline, reaction to litmus. On the other hand, the fact that only soils capable of setting free acid from potassium chloride solutions give a distinct acid reaction to litmus, proves that the capacity of a soil to turn neutral litmus solution red is due to the fact that it contains substances with an effective acid reaction. Hence the importance of the litmus test in soil investigations, especially when it is necessary to know the requirements of the soil in basic substances.

The determination of the soil's power to absorb bases is not sufficient for an estimation of the soil's lime requirement, for it has been found that many soils which, by the preceding investigations, were shown to be deficient in lime (e. g. by the absence of development of *Azotobacter*), are less capable of liberating the acid of a calcium acetate solution than other soils which do not show a deficiency of lime (by the *Azotobacter* test).

The determination of the acidity of the soil gives no certain indication of its lime requirement. As has already been shown, all mineral soils giving an acid reaction to litmus have a great need of lime, and, in such cases the determination of the acidity of the soil not only shows the amount of lime required to neutralise the acid present, but also gives an estimation worthy of consideration although inadequate, of the soil's lime requirement. Nevertheless it must not be forgotten that many soils giving a neutral reaction also have a very real need of lime, and, in these cases, the determination of the acidity will give no indication of this need.

Stress should be laid on the fact that the qualitative determination of the lime requirement by the combined litmus and *Azotobacter* test, in general use in Denmark, does allow this requirement to be estimated up to a certain point. There is no doubt that soils giving an acid reaction usually require a larger quantity of lime than neutral soils in which *Azotobacter* is absent. A large number of experiments with field tests are still required to clear up the important question of lime treatment.

As the Author stated previously, it is probable that the question of

the lime requirement of soil is primarily one of the presence or absence of certain compounds of calcium or magnesium which saturate the acids and are easily decomposed. If this be so, experiments aiming at expressing quantitatively the soil's lime requirement, should seek methods which will show the amount of lime necessary to supply the soil with a sufficient quantity of these compounds. At present it is still impossible to know whether such methods can be devised, and whether they should be based on chemical or biological criteria.

7 - **The Quantitative Estimation of Calcium Carbonate in Determining the Nature of Soils.** — PASSERINI, N., in *Bullettino della Società Botanica Italiana*, Nos. 1-5, pp. 50-52. Florence, April-May, 1917.

When soil is called granitic, serpentinous, or trachytic, reference is made, not to its composition, but to its origin. On the contrary, when speaking of calcareous soil, it is usually meant that it is also rich in calcium carbonate. Because a soil is derived from limestone it does not, however, mean it is rich in calcium carbonate, for there are compact limestones which contain relatively little. The various factors causing loss of calcium carbonate must also be taken into consideration. The necessity for a quantitative estimation of calcium carbonate, even though it be but proximate, is thus clear.

This necessity is further proved by the results of 21 determinations of calcium carbonate (1) made in different soil samples from the same compact limestone ("Alberese"). The amount of calcium contained in them varied between 0.1 % (traces) and 55.90 %, thus showing that the composition varied greatly in the soils tested, although they were all taken within small area. By their origin all these soils were calcareous, but, if this term to include their richness in calcium carbonate, it should only be applied to four of them which contained from 23.65 to 55.90 % of calcium carbonate. It is, therefore, not impossible that a quantitative estimation of calcium carbonate would modify the classification of plants as *calcicolous* and *calcifuges*, a classification which frequently is only based on a qualitative estimation of the rock.

8 - **Cultural Experiments in Mangrove Plantations in Madagascar.** — TOULON, N., in *Revue agricole et vétérinaire de Madagascar et Dépendances*, No. 9, pp. 36-40 + 1 pl. Tananarive, July, 1917.

On the Madagascar coast there are large stretches covered with mangroves. As the cultivation of mangroves has been carried out in too intensive a manner, and as the plants grow very slowly, it has been suggested that the plantations might be converted into cultivable land. These soils, which are under water at high tide, are usually composed of a thick mass of more or less decomposed vegetable matter, mixed, according to the deposits from the sea or neighbouring rivers, with sand or mud, or even with alluvium. They are often very rich and form a valuable capital.

(1) Carried out with the Author's calcimeter.

An interesting cultural experiment in mangrove plantations was undertaken on the west coast of Madagascar. The land chosen is submerged at high tide only.

The experiments were started in 1913 on small plots of about $7\frac{1}{2}$ acres which were dammed and planted with coconut trees. The results were so satisfactory that a further experiment on a larger scale was attempted. The work was started in 1914, interrupted by the war, continued in 1915 and finished only in 1917.

The land chosen had an area of about 198 acres; it is from 1.64 to 4.83 feet below the level of high tide, that is to say, about 8.20 feet above the low waters of the spring tides and only 3.28 to 4.82 feet above the low waters of the neap tides.

The soil is silicious sand mixed in places with clay, all amalgamated to a depth of many feet, by an accumulation of badly decomposed vegetable detritus composed of mangrove roots and leaves. The whole forms a very rich, permeable soil, but saturated with water and a large number of injurious substances.

The land was first isolated from the sea by temporary dykes and the work then begun. The permanent dykes vary in size according to the level of the land. Viewed in section they form a regular trapezium, whose small base (summit) is 8.20 feet wide, and whose sides have an incline of 45° . The summit is 3.28 feet above the highest tides. The total height, from about 11 to 13 feet. The whole structure is of well-beaten earth covered with dog's tooth grass (1), which is resistant to salt water.

These dykes are cut by three stone-works, each of which has two automatic wooden valves which close the openings of cement conduits with an internal diameter of 1.30 feet. The stone-work and conduits form a very strong mass, supported by piles well driven in.

Drainage is by 14,344 feet of canals, 5 feet wide by 4 feet deep placed 33 feet apart, and by three collectors, 10 feet wide and 5 feet deep which empty their water into three reservoirs, which lead it into the neighbouring 'arroyos'. Soil drainage is thus assured to a depth of about 3.2 feet.

The ground was planted with 11,000 coconut trees, and several acres were also planted with rice. The cost amounted to about £9 per acre planted with 59 trees. The success of this experiment is almost assured.

It is necessary to prepare the mangrove plantations two years before cultivating it, in order that it may be sufficiently freed from salt and the large quantities of tannin contained in the vegetable detritus.

As rice is fairly resistant to salt and as the ground is really salt on the surface during the dry season only, the cost of reclaiming the land for no growing should not exceed £1 to £3 per acre.

(1) See also *R.*, June, 1917, No. 525.

99 - The Construction of Reservoir Dams in France. -- LEVY-SALVADOR, PAUL, in *La Nature*, No. 2295, pp. 177-182, 8 figs. Paris, September 22, 1917.

In the central massif range of France there is a fair number of stone reservoir-dams, all built of hydraulic lime mortar. The perfect state of preservation of some of them after fifty years shows what excellent results may be obtained by this method of construction. Although many of the dams recently built in France and abroad, especially in the United States, are made of other material, such as steel, reinforced concrete, or cement, stonework still seems to offer the greatest guarantee of safety for works the upturn of which would entail disastrous consequences. It is only this question which the author studies, explaining the principles to be observed in making a reservoir-dam. As an example the Cher dam is taken. This dam, about 9 miles from Montluçon, is 154 feet high and holds 1060 million cubic feet of water with only 529 640 cubic feet of stone work.

The site of the dam must answer a certain number of requirements rarely found together. The transverse section of the gorge to be dammed must be as narrow as possible, so as to reduce the stonework required. Up stream the bed must open out so as to form a large basin, otherwise the cost per cubic foot stored will be excessive. Care must be taken not to flood valuable land, houses, or roads, as derivation entails considerable expense. The durability of the work depends as much on the nature of the soil and the bed as on the walls. The soil must be resistant both to compression and undermining, with neither faults nor clay pockets, which, in time, would ruin the wall. A geological study by means of borings is indispensable.

The geological study made for the Cher dam gave most satisfactory results; the bed was of very hard grey granite, there was no fear of faults, and the perpendicular fissures could easily be stopped up. Care must be taken to ascertain that, in the area to be flooded above the dam, there are no leaks through which the stored water may escape. Once the desired site is found the work may be proceeded with. The density of the stone on the site is determined by direct weighing, and it is tested for its degree of porosity, its permeability, its resistance to compression, strain, etc. The density of the stonework may be established by a very simple calculation. The stone of the Cher dam weighed 2670 kg. per cubic metre. The mortar, containing 50 kg. of hydraulic lime per cubic metre, weighed 1900 kg. per cubic metre. The usual proportion of mortar in stonework is 40 % of the volume; this as deducted for the density of the stonework:

$$(2.67 \times 0.6) + (1.9 \times 0.4) = 2.36.$$

Calculations are then made of the necessary measurements of the transverse section of the wall at its highest point. The form most generally used for the transverse section of the wall is that of an isosceles rectangular triangle, whose vertical side represents the up-stream wall. In practice this wall has a slight batter (0.10 to 0.20 per metre). The size of the coping of the wall depends on local conditions (4 to 10 metres). The construction rests on a very thick stone base, firmly built into the ground at the foundation.

The conditions of resistance which the construction must fulfill are laid down in a circular of the French Department of Agriculture under date June 15th., 1897. The essential conditions are:

- 1) The impossibility of slipping in a horizontal direction, that is to say, the weight of the stone work must be greater than the water pressure;
- 2) The limitation of the maximum compression stress in one point of the down-stream wall: In practice the compression stress may without danger reach $\frac{1}{30}$ of the breaking stress. The compression stress of stonework may conveniently be limited to 12 kg. per square centimeter in dam walls not exceeding a height of 30 metres, but, for constructions reaching a height of 70 and 100 meters, at least 15 kg. per square centimeter may be allowed if the soil at the foundations is very resistant and the materials of good quality.
- 3) The stones of the up-stream wall to be subjected at the joints to a minimum compression at least equal to the pressure of the under-current. This condition, which is necessary to prevent cracks in the construction, is sometimes fulfilled by increasing the thickness of the construction.

The stonework of the up-stream wall should be as watertight as possible. For this purpose the Cher dam was first covered with a 3 cm thick coating of Portland cement mortar containing 600 kg. of cement per cubic metre of sand. Over this was laid a thick layer of coal-tar, covered with milk of lime to prevent too great an absorption of heat by the black colour when the reservoir is empty. These measures seemed sufficient for a 47 metre wall. The down-stream wall was simply pointed.

The dams are based on the arc of a circle with a radius of 150 to 200 metres, the convexity being turned up-stream. This arrangement has two advantages: 1) to build the construction let in two sides of a gorge, like an arch, thus gaining increased resistance; 3) to close any possible opening of vertical fissures produced by the expansion and contraction of the masonry under the influence of the heat of the sun.

Though the construction is influenced to a certain degree by local conditions, it varies very little on the whole.

A description of the building of the Cher dam, begun in July 1906, and finished during 1909, is given and may serve as an example for the construction of stone dams.

1000 - **Blasting Ditches.** - MURDOCK, H. P., in *Montana Agricultural College Experiment Station Circular No. 55*, pp. 6, figs. 7. Bozeman, Montana, February, 1910.

The circular describes the blasting of drainage ditches on the Bozeman Experiment Station farm between the years 1913 and 1915, and gives practical details of the work.

It is particularly in gravelly and rocky soil that ditching is difficult and that blasting may be carried out to advantage.

Preparatory to starting the work all the brushwood is cleared off. Holes are then dug 22 inches apart. Experience showed this distance to be the most satisfactory; if it be less there is unnecessary waste of explosive, if more some of the charges misfire. Two sticks of 60% Hercules dynamite are placed in each hole, which are dug by steel bars $2\frac{1}{2}$ feet long.

driven in the earth to within 4 or 6 inches of the surface, and withdrawn either by hand or machine.

To prevent the holes from caving in, tubes made of 1 inch galvanised iron pipe are inserted and the charge passed in through them. The pipes are then withdrawn. As the holes fill with water no further tamping is necessary. About 25 holes are exploded at once, the middle hole being used as the primer and joined to the others by a waterproof fuse. An electric detonator may be used.

Three men are necessary for the crew. The channel made by the explosion is 2 to 3 feet deep and 5 to 7 feet wide. After blasting, the channel is cleared out by hand. As dynamite freezes very easily, the work must be done at a suitable season.

The following comparative expenses of making open ditches were drawn up from the Station accounts:

Hand dug ditch	\$ 3.35 per rod
Blasted ditch	{ hand labour, inexperienced \$ 3.10
	{ hand labour, experienced \$ 2.36

Blasting ditches by dynamite has proved both practical and economical under the conditions existing at the Station. No piles of dirt are left along the bank, thus ensuring a good flow of surface water. The figures illustrating the circular show that the ditches may be made very regular, and allow the comparison of work carried out by a ditching machine and that carried out by dynamite.

201 - Drainage-Ditches excavated by means of Internal-Combustion Engines. — See No. 1053 of this Review.

202 - Experiments in Irrigated Crops in the United States. — I. KNOWN, F., Management of Irrigated Land, in *Bulletin of the Agricultural Experiment Station of Nebraska*, Vol. XXVII, Art. IX, *Bulletin* No. 152, 24 pp. 12 tables. Lincoln, Nebraska, June 1915. — H. HARRIS, F. S., The Irrigation of Potatoes, in *Utah Agricultural Experiment Station, Bulletin* No. 157, 20 pp., 8 fig. + 1 plate. Logan, Utah, June 1917.

I. — Experiments carried out for 3 years at the Scottbluff Experimental Farm, Nebraska, by the University of Nebraska in cooperation with the U. S. Department of Agriculture, on about 30 acres of land capable of irrigation, in order to determine the value of autumn irrigation in increasing spring crops.

In the region under consideration, the rainfall is very small and it is therefore necessary to irrigate the land in the spring before sowing. The object of autumn irrigation is to store up water in the soil for the use of the spring crops. One advantage of autumn irrigation is that the soil has an opportunity to freeze and thaw during the winter, thus aiding to produce better tilth in the spring. If the water is evenly distributed, autumn irrigation is very beneficial.

Compared with the plots which were not irrigated in autumn, the plots

irrigated at this season gave excellent results; the average crops during period of 3 years being as follows:

Wheat: 5.5 bushels per acre.

Barley: 7 bushels per acre.

Oats: 11 bushels per acre.

The averages for a 2 years' period were:

Maize: 10.6 bushels per acre.

Sugar-beets: 1.6 tons per acre.

Potatoes: 2.3 bushels per acre.

The land for the experiment plots was broken out of the virgin sod during the autumn of 1910 and irrigated after ploughing. It was necessary to work down the land previous to irrigation. In 1911, and in succeeding years, the land, being light, was irrigated in the autumn and ploughed as soon as it was dry enough. It was found that land irrigated in autumn did not require as early irrigation in the summer and thereby saved considerable labour at this time of the year. The cereals received 2 irrigations, the maize 1, and the beets and potatoes 3.

Potatoes. — In 1912, an experiment was begun to determine the best method of irrigating potatoes, taking also into account the methods of cultivation, labour, and water requirements:

So far, this experiment has only furnished useful data concerning irrigation.

The usual practice has been deep cultivation and ditching; the cultivation is often from 5 to 8 inches deep, and when the potatoes are properly ditched, the ridges are over 1 foot high. In common practice, every row is irrigated throughout the season after irrigation once becomes necessary.

The 5 methods of applying water in the experiment have been:

- 1) To irrigate every row, keeping the soil moist, and the plants in a growing condition. Yield: 296 bushels per acre.
- 2) Not to irrigate until the plants require water, then to irrigate every row and irrigate according to common farm practice: Yield: 270 bushels per acre.
- 3) Irrigate every row, but permitting the plants to suffer between irrigations. Yield: 234 bushels per acre.
- 4) To irrigate alternate rows at such times as the crop requires moisture; at the second irrigation the skipped rows are irrigated and the previously irrigated rows omitted. Yield: 239 bushels per acre.
- 5) To irrigate every other row throughout the season. Yield: 215 bushels per acre.

Under the usual method, it required approximately 2 hours and 30 minutes to run through rows 264 ft. long. Where water was run in alternate rows, it required 5 hours running, and then the soil was not in as good condition as when every row was irrigated.

II. — The experiments in the irrigation of potatoes at the Greenville

periment Farm, Utah, lasted for 5 years. The soil is a well drained uniform clay loam to a great depth.

The Bulletin analysed passes in review most of the literature dealing with the subject. The results of the experiment are summarised as follows: The highest yield of potatoes was produced where small, irregular irrigations were given.

One inch weekly, or a total of 12.8 inches during the season, gave a better yield than any other treatment.

When as much as 96 inches of water were applied, the yield was less where no water was given. Watering the land after planting the potatoes and before the plants were up, reduced the yield below that where no irrigation was given.

Where but one irrigation was applied, it gave best results if applied when the potatoes were in full flower. The second best stage was just as the tubers began to form.

Discontinuing irrigation during the rapid growing season, after it had begun, decreased the yield.

Excessive moisture, or that applied late in the life of the plant, increased relative production of vines. The relative number of tubers per hill increased by early irrigation, while the relative size of the tubers was increased more by late water.

Height of vines was affected much less by the treatment than yield of tubers.

The experiment brings out the importance of an even supply of soil moisture during the middle portion of the life of the potato after the tubers begin to form, and before they begin to ripen.

Lime on the Farm in New South Wales, Australia. — GUTHRIE, F. B., in *Department of Agriculture, New South Wales, Farmers' Bulletin* No. 115, pp. 31. Sydney, July 1917. Instructions of a monographic character upon the different uses of lime in practical agriculture.

After having set forth the advantages of liming, and the lime content of New South Wales soils, the writer considers the different forms in which lime is applied — carbonate of lime — agricultural, or mild lime (containing about 82 per cent. of lime); this is the name given locally to the stone-lime that has not been properly burnt — gas lime — residual lime from acetylene generators — spent lime from tanneries — wood ashes and plant ashes — gypsum — basic slag.

The residual lime from acetylene generators contains from 36.19 to 53 per cent. of lime. It can be used in a fresh state, while gas lime must be exposed to the air for some time before being applied.

A sample of spent-lime from tanneries contained in addition to an appreciable amount of nitrogen and traces of phosphates and potash, 49.5 per cent. calcium hydrate and 26.0 per cent. of calcium carbonate.

Among the Australian ashes analysed, the case of the ash of *Gidgea* is exceptional. This contains 95 per cent. of pure calcium carbonate. It is of great value in neutralising the carbonate of sodium which ren-

ders soil, or water, alkaline and caustic. The writer mentions an experiment in which the alkalinity of a water estimated at 35.28 grains of sodium carbonate per gallon was reduced to one half after 24 hours, and to 10 gr. in 6 days, after which the decrease was very gradual.

The writer gives the amount of lime to be used for liming and sets forth the bad effects of lack of lime in the soil, and of its excessive use or misapplication. He then deals with the other uses of lime on the farm: in the formation of the compost heap — as a fungicide or insecticide, whether alone, or mixed with other compounds, or in the form of gypsum — for softening water when hardness is due to the presence of calcium carbonate — for making whitewash — for waterproofing corn-sacks — for making artificial stone.

The writer concludes by expressing his hope that the present concessions for agricultural lime will be extended to all forms of lime suitable for agricultural purposes in Australia.

1004 - **The Composition of Army Stable Manure.** — **ROSSELL, E. J.** (Rothamsted Experimental Station), in *The Journal of the Board of Agriculture*, Vol. XXIII, N. pp. 1053-1055. London, 1917.

In many parts of the country, Army stable manure is being produced in considerable quantity. Several samples of this manure have been analysed at the Rothamsted Experimental Station. The results obtained are summarised in the following tables, which also show how this manure compares with ordinary manures.

Percentage Content of Army Stable Manure in Comparison with Farmyard Manures.

Composition	Army stable manure				Farmyard manure Rothamsted	
	8 months old	Old	New	New	Farm Stable manure	Cake-fed
Organic matter	20.7 %	28.3 %	22.2 %	19.6 %	20.5 %	—
Mineral matter	13.1	21.1	30.8	41.3	4.0	—
Moisture	66.2	47.6	47.0	39.1	74.9	72.0 %
Total dry matter	33.8	52.4	53.0	60.9	25.1	27.4
Total nitrogen	0.524	0.503	0.470	0.475	0.442	0.77
Nitrogen as ammonia	0.105	0.110	0.106	0.120	0.10	0.18
Potash	0.82	0.94	0.87	0.53	0.73	0.60
Phosphoric acid	0.20	0.33	0.40	0.31	0.24	0.34

From these figures, it is evident that army stable manure is very being as rich as ordinary farmyard manure in nitrogen, though it falls good cake-fed manure. The Army horses are well fed, so that the are rich. Unfortunately, from the farmer's point of view, the stalls

igned primarily for the making of manure, and consequently most of the line is lost, and it is therefore not as rich as bullock manure, made on an usually liberal diet, where the urine is saved. The Army manure contains very little litter, though straw or peat is used, while the method of stabling and collection is such that the solid excreta constitute the larger part of the manure. This is shown in the relative dryness of the Army manure; there is, however, a large proportion of mineral matter, much of which is sand or grit which has been swept up and is of no fertilising value. These impurities rose to 41 per cent. in one sample, the other figures being 13, 24 and 31 per cent. respectively; ordinary farmyard manure contains about 5 per cent. Consequently, the nitrogen, phosphoric acid and potash are not very different amounts from the ordinary figures. The ammoniacal nitrogen content is lower, while the potash content is slightly higher than in ordinary manures. Thus, even apart from its organic matter and its nitrogen, Army manure is especially valuable as a source of potash. In fact, 1 ton of it contains 18 cwt. of potash and a dressing of 12 tons contains as much as 15 ½ cwt. of potash or 3 ½ cwt. of sulphate of potash.

The condition of the manure is all that could be desired, as it is in a finely-divided state in which it can easily decompose in the soil. It should be noted that there is not much difference between old and new samples, as is the case with farmyard manure. Horse manure exposed to the air has less nitrogen than farmyard manure. This is partly due to the circumstance that the dumps are made as compact as possible in order to check breeding of flies and to economise space, and partly to the lower proportion of ammonia present in Army horse manure which therefore does not suffer so great a loss on storage. Another fact may be the actual fixation of nitrogen (1).

The price of Army horse manure in England varies usually from about 1 ½ d. to 1 s. 4 d. per ton. In one place it is 2 s. 6 d., but even so, it is worth at least 5 s. per ton on the farm. In view of the high value of this manure, its use is to be advocated wherever the transport conditions permit.

5. **Value of Duck Manure.** — *Mark Lane Express Agricultural Journal*, Vol. 117, No. 2400, p. 195, London, 1916 (2).

The high value of duck manure is recognised by those who have kept ducks, but does not appear to be appreciated by farmers generally. Upon question scientific observation is needed, but those who keep large numbers of ducks bear testimony to the remarkable improvement in the herbage pastures upon which the ducks have been thickly kept for one season. Their practical experience leads to the conclusion that the manurial effect is felt for three or four years. In some instances the number of ducks kept is so large that the grass appears to be entirely eaten off, and the

(1) See *R.* September 1917, No. 707.

(Ed.)

(2) Cf. *STORACE, F. H.* *Agriculture in Some of its Relations with Chemistry*, Vol. I, Seventh Edition, New York, 1905.

(Ed.)

earth is quite bare ; the grass, however, springs up luxuriantly the following year, the manure apparently favouring the finer grasses. Hence ducks may have an economic value in the improvement of pastures, apart from any profit which they may yield. Upon farms where fresh ground can be used the ducks annually they may take the place of larger stock, and avoid the necessity of using so much artificial fertilisers.

1006 - **A New Source of Potash in England.** — I. CRANFIELD, HAROLD, T., A New Source of Potash, in *The Journal of the Board of Agriculture*, Vol. XXIV, No. 5, pp. 526-9.
— II. Blast Furnace Dust, *Ibid.*, p. 182.

For several years, it has been known to chemists that flue-dust and gases driven off from iron blast furnaces contained an appreciable percentage of potash, but only recently has the suggestion been made in England that these by-products might be of value for agricultural purposes. The suggestion was due to the sudden cutting off of the German exports of potash salts which had hitherto been the most important source of the potash to British farmers (1).

The writer has made a preliminary investigation of the flue-dust from several blast-furnaces in the Midlands. He found that the ironstone in which the furnaces are partially fed contains a small percentage of potash. 3 samples on analysis gave an average of 0.2 per cent. potash. Potash is also present in the fuel, one or two analyses of coal and coke giving figures ranging from 0.15 to 0.4 per cent. of potash. The enormous heat at the base of the furnace appears to break down the potassium silicates, potassium oxides in the gaseous state being formed. This, in turn, reacts with sulphates and chlorides present, producing potassium sulphate and potassium chloride. These potash salts condense in the cooler regions and pass up the furnace in the form of fine dust. The particles become coated with carbon and pass into the main down-flue. At the bottom of this is a cavity which retains the greater bulk of the dust (about 75 to 85 per cent.) in the form of a coarse black powder. The finer particles, which contain the greater proportion of potash salts, are carried to the round boilers where the flue-dust is deposited. It is brick-red in colour, and somewhat finer than the black dust. Many of the later-deposited flue-dusts are cream-coloured, and very heavy. They constitute the richest source of potash.

The analyses of the writer give the following data for these different products:

	Total acid soluble potash		Water-soluble potash	
	—	—	—	—
Black dust (3 samples)	2.97	5.12 %	1.23	2.01 %
Red dust (2 samples)	7.58	8.50	4.68	5.92
Cream dust (2 samples)	11.82	15.89	3.60	4.25
Grey dust and light brown dust (3 samples)	7.10	12.46	3.82	5.58

(1) See the paper by R. J. WYSON, *American Institute of Mining Engineers*, February 1917, quoted by the writer. See also R. 1916, No. 623. (Ed)

The black dusts contain insoluble ferrous compounds. Insoluble sulphides are also present, and occasionally soluble cyanides, sulphites, and even free alkali, in which case the dust should be avoided for agricultural purposes. The red dusts are rich in ferric oxide, while many of the cream dusts contain either free lime or calcium carbonate. All are rich in silica and silicates. The potash exists mainly as potassium sulphate with a smaller proportion of chloride, the remainder being in an insoluble form. The availability of the latter is a subject for urgent investigation. The amount of soluble potash varies much; in samples examined by the writer the variation was between 50 and 70 per cent. of the total potash. After extracting the fine dust with hot water, evaporation of the extract yields a white residue which contains on an average 70 to 80 per cent. of potassium sulphate and chloride, corresponding to 40-42 per cent. of potash (K_2O), the principal impurities being sodium chloride and calcium sulphate.

The writer gives a rough approximation of the total amount of potash which could be obtained from the blast furnaces of Great Britain.

Number of furnaces in full blast	199
Tons of blue dust produced per furnace per week	
Black, with 2 per cent. potash	20
Red, with 7 per cent. potash	5
Cream, with 10 per cent. potash	1
Total of tons of potash produced per furnace per week	0.05
Total of tons of potash produced per furnace per annum	50

This would give for the whole of Great Britain a total annual production of 15,000 tons from the *blast-furnace dust*, of which at least 50 per cent. would represent soluble potash. The writer therefore considers this to be the most important source of potash yet discovered in the country, and until arrangements can be made and plant erected for the extraction of the water-soluble potash salts, the raw fine dust might be utilised on land which has become very deficient in potash during the last 2 years.

It is evidently on account of these facts that the British Ministry of Munitions has issued an order dated August 7, 1917, to the effect that no person shall buy, sell, deal in, or dispose of any blast-furnace dust, except under and in accordance with the terms of a licence issued on behalf of the Minister of Munitions by the Controller of Potash Production.

907 - **Production of Nitrates by the United States Government.** — I. Nitrate Supply Committee Recommendations on Synthetic Nitric Acid for the Government with Reports on Various Methods. *The Journal of Industrial and Engineering Chemistry*, Vol. 9, No. 9, pp. 829-841. Easton, Pa., September 1, 1917. — II. Production of Nitrates by the Government. *Science*, N. S., Vol. XLVI, No. 1185, pp. 250-258. Lancaster, Pa., September 14, 1917.

The United States War Department gives an account of its preparations for the production of nitrates in accordance with a report filed by the Nitrate Supply Committee.

The Nitrate Supply Committee, appointed by the U. S. Secretary of War, was under authority of a provision in the national defence act for an

investigation "to determine the best, cheapest and most available means for the production of nitrates and other products for munitions of war and useful in the manufacture of fertilizers and other products".

The general recommendations, dated May 11, 1917, of the Nitrate Supply Committee are reported as follows :

1) The Committee, appreciating the offer of the General Chemical Company, recommends that the government enter into negotiations to acquire the rights to use the synthetic ammonia process of that company.

2) That contingent upon satisfactory arrangements with the General Chemical Company out of the \$20 000 000 nitrate supply appropriation such sum as may be needed, now estimated at \$3 000 000 be placed at the disposal of the War Department to be used in building a synthetic ammonia plant, employing the said process of the General Chemical Company and of a capacity of 60 000 pounds of ammonia per 24-hour day, the said plant to be located in a region where land, water, coal and sulphuric acid are cheaply available, where good transport facilities exist, and where the proposed new powder plant of the government can be properly located. In the opinion of this committee all of these conditions just enumerated are best fulfilled by a location in southwest Virginia or some contiguous region.

3) That out of the \$20 000 000 nitrate supply appropriation an amount now estimated at 800 000, or as much as may be needed, be placed at the disposal of the War Department to be used in building a plant for the oxidation of ammonia to nitric acid and the concentration of nitric acid, of a capacity equivalent to 24 000 pounds of 100 per cent. nitric acid in a 24-hour day, the said plant to be located in the neighbourhood of the aforesaid synthetic ammonia plant and the proposed new powder plant of the government.

4) That the War Department proceed at the earliest possible date with the construction of the oxidation plant and, contingent upon a satisfactory arrangement with the General Chemical Company, also with the synthetic ammonia plant, and that the government give as priority orders as will secure from contractors prompt delivery of the materials and the construction of the structure and machinery needed for those plants.

5) The Committee, appreciating the offer of the Nitrogen Products Company, granted in this country, to the government, under certain conditions the right to use the so-called BUCHER process for the production of sodium cyanide and ammonia, recommends that a contract, drawn with the advice of the legal authorities of the government, such as to grant that company no guaranty or exclusive rights in the process, or in its future development beyond those which the company's own patents give to it, be entered into with the Nitrogen Products Company, and that experimentation looking toward the industrial development of the BUCHER process for the production of ammonia be at once proceeded with. And, further that contingent upon a satisfactory arrangement with the Nitrogen Products Company, a sum not to exceed \$300 000 be allotted for this purpose out of the \$20 000 000 nitrate supply appropriation.

6) That out of the \$20 000 000 nitrate supply appropriation \$100 000 be made available for the active prosecution of investigations of processes for the industrial production of nitrogen compounds useful in the manufacture of explosives or of fertilizers, and that the investigations be planned and supervised by the War Department.

7) That in order to increase the production of ammonia and to aid the government to note the installation of by-product coke ovens by directing that priority be given in the production, delivery, and transportation of the materials and parts needed in their construction.

8) That the decision as to more extensive installation of nitrogen fixation processes and water power development in connection with them be postponed until the plants above recommended are in operation or until further need arises.

9) While the preceding recommendations include all the measures that can now judiciously be taken for the fixation of nitrogen and the oxidation of ammonia, it is the opinion

the committee that the immediate accumulation and the permanent maintenance of an ample reserve, not less than 500 000 tons of Chile saltpeter, is the measure most urgently necessary.

The Nitrate Supply Committee comprised U. S. Army and Navy officers, representatives of the Bureau of Soils, U. S. Department of Agriculture, of the Bureau of Standards, U. S. Department of Commerce and of the Bureau of Mines, Interior Department, as well as scientific men and engineers.

48 - **The Presence of Arsenic in Hops, in the United States.** — STOCKINGER, W. W. (Physiologist in Charge of Drug-Plant and Poisonous-Plant Investigations, Bureau of Plant Industry), and COLLINS, W. D. (Food-Investigation Chemist, Bureau of Chemistry), in *U. S. Dept. of Agriculture, Bulletin No. 568, Joint Contribution, from the Bureau of Chemistry and the Bureau of Plant Industry, Professional Paper, 7 pp.* Washington, D. C., August 8, 1917.

Traces of arsenic having been occasionally found in consignments of hops exported from America, the consignments were refused. This had bad effect on the production of hops in the United States, as the profit largely depends on the possibility of exporting the excess of production over the home-consumption requirements.

Experiments made on sun-dried hops from various hop-gardens of the region in 1915, showed that, practically speaking, no arsenic was present. Analyses of the various sprays ordinarily used for fungus control (whale-oil soap, quassia wood, nicotine sulphate) showed that there was no possibility of arsenical contamination being derived from them. On the other hand, the sulphur used for bleaching the hops produced in 1914 and 1915 usually appears to contain arsenic as an impurity. In fact, a large number of samples were found to contain more than 100 millionths of arsenic anhydride. It is thus quite possible that hops treated with such sulphur could contain about 3 or 4 millionths of arsenic.

It is perfectly clear that the impure sulphur used for bleaching is the cause of the contamination of the hops with appreciable amounts of arsenic, and this confirms previous supposition.

49 - **The Presence of Nitrites and Ammonia in Diseased Plants.** — I. BONEQUET, P. A., in *The Journal of the American Chemical Society*, Vol. XXXVIII, No. 11, pp. 2872-2876, Easton, Pa., November 1916. — II. BONEQUET, P. A., and BONEQUET, M., *Ibid.*, Vol. XXXIX, No. 9, pp. 2088-2093, Easton, Pa., September 1917.

I. — This work shows that in the extracted juices of plants infected with diseases of the so-called physiological type, such as curly leaf of sugar beets, curly dwarf of potatoes (1), mottled leaf of potatoes (2), mosaic disease of tobacco (3), the presence has been detected of nitrites and ammonia which are supposed to be due to the reduction by bacterial action of the nitrates absorbed from the soil.

(1) See *B.* 1914, No. 575. (2) See also *R.* 1916, No. 1228. (3) See *B.* 1915, No. 554.

This opinion is based on the fact that the presence of nitrate-reducing bacteria in the plant tissues runs parallel with the presence of nitrites and ammonia in diseased plants.

It is also believed that lack of crop rotation increases the virulence of the reducing bacteria and gives these organisms a better opportunity of establishing themselves in the tissues of plants. By this means the crop is so much decreased that it might be supposed that the soil is depleted, whereas the nitrogen starvation is due to the bacterial activity in the plants which brings about internal nitrate-reduction.

II. — In the second paper, the facts reported seem to corroborate the idea of nitrogen starvation of plants by the bacterial reduction of nitrates to nitrites and ammonia, after they have been taken up by the roots. In these diseases, similar phenomena occur in the parts affected; and similarity is especially noticeable if the cell is considered as an unit of life.

The response to this stimulus is so strong as to manifest itself in biochemical, physiological, and even morphological changes. All these responses and adaptations apparently have in view the one end of supplying the necessary nitrogen to the plant cell. This increase of biological activity, however, is in itself a pathological phenomenon. As the disease progresses the symptoms of nitrogen starvation become more and more apparent till the plant finally makes no further progress in growth, but completes its life cycle in a dwarfed condition, or dies before reaching maturity.

However, in plants inhabited by nitrate-reducing organisms such as *Bacillus morulus*, in sugar-beets affected with curly leaf, *Streptococcus Solani*, in potatoes attacked by mosaic disease, the biological, physiological and morphological phenomena seem to work in harmony for the preservation and increase of the nitrogen content of the tissues. Preservation seems to be the aim and object of the oxidizing enzymes which tend to neutralise the reducing action of the bacteria. The biochemical phenomena appear to be the first to respond to the stimulus of the invader. Amongst these the first noticeable are the decrease and subsequent increase of the oxidases. The diastases also increase and are localised in the tissues owing to the stimulus of the internal reducing bacteria. The formaldehyde content increases noticeably in the juices of diseased beetroot leaves; this phenomena, however, has not yet been sufficiently studied to permit the drawing of conclusions. In the leaves of tobacco plants affected with mosaic, the starch content increases to correspond with the greater chlorophyll activity due to the stimulus. Sugar beets affected with curly leaf have, as a rule, a higher sugar content in the roots than normal beets. Morphological adaptations, such as the reduction in size of secondary organs, that occur after infection, seem to economise on nitrogen and preserve it for the more essential parts of the plant, such as roots and leaves. The increased tendency to supply the plant with nitrates necessary for the building up of the tissues, seems to be demonstrated by the fact that the plant uses more water per unit of dry weight and also by the increase of the root system. The consequence of this

in all likelihood, an increase in ash content which, if the plant were normal, would mean most probably an increase in total nitrogen. The fact, however, that no matter how well the plant has succeeded in absorbing a surplus of water from the soil, a deficiency of total nitrogen is found in the tissues, suggests the idea that the bacteria, in reducing nitrates to nitrites and ammonia, have wasted this necessary element, thus bringing about a disease of nitrogen starvation. A disease which also seems to present all the morphological adaptations to nitrogen starvation is the bramble leaf disease of the vine (1).

1010 — **Self-Sterility in Plants.** — MOORE, C. W., in *The Journal of Heredity*, Vol. VIII, No. 5, pp. 293-297, Washington, May, 1917.

The object of the work was to find some clue as to the nature or cause of self-sterility, the term being taken to mean that the pollen of a flower is not capable of fertilising the ovules of the same flower, while being capable of fertilising the ovules of another plant. The distinction was made to distinguish between plants having abortive pollen or ovules, and plants having self-sterile flowers.

Various plants said to be self-sterile were grown and the stigma and style were examined. The plants used for the experiments were *Tradescantia*, like clover, alfalfa, and the Shirley poppy (*Papaver rhoeas*).

On 12 plants of *Tradescantia*, 83 self-pollinations were made, but none of them set seed; 26 cross-pollinations were made and all of them produced seed. A microscopical examination of the styles showed that, while the self-pollinated flowers showed good germination of the pollen, yet the pollen tubes did not grow down the style. Self-sterility, in this case, appears to be due to failure of the pollen tubes after germination.

Careful measurement of the diameter of the pollen tubes showed that while the diameter of those from self-pollination was, on an average, 0.0216 mm., it was only 0.0144 mm. in the case of pollen tubes from cross-pollination. This difference in diameter was shown not to be so great as to prevent growth of the pollen tube down the style, since the smallest tube from a self-pollination had the same diameter as the largest from a cross-fertilisation.

The results obtained from the three other plants are shown in the following table, those from *Tradescantia* being included for the sake of comparison.

Results of the self-pollinations and cross-pollinations.

Plants	Number of Plants used	Self-pollination		Cross-pollination	
		No. of flowers pollinated	Percent of flowers setting seed	No. of flowers pollinated	Percent of flowers setting seed
<i>Tradescantia</i> sp. and hybrids	12	83	0.0%	26	100.0%
like clover	14	1452	2.75	1437	21.5
Alfalfa	8	1459	27.10	822	38.7
Shirley poppy	20	80	30.50	75	84.0

(1) See *B.* 1914, No. 681; *R.* 1918, No. 1022.

(Ed.)

From the above table it will be seen that *Tradescantia* was completely self-sterile, while alsike clover, and alfalfa showed varying degrees of self-sterility. With the Shirley poppy, since but 84 % of the crosses set seed, it is possible that a number of the plants may have been cross-sterile.

From a morphological standpoint the pollen tube of the angiosperm has two functions: 1) the transferring of the male generative nucleus to the embryo sac, and 2) the function of growth, which is one of food assimilation. In the manner of assimilation the pollen tube acts in a similar manner to the mycelium of a fungus.

The writer next considers the theories put forward by various workers (COMPTON, CORRENS, EAST) on self-sterility, and thinks that COMPTON's hypothesis, that self-sterility in plants may be analogous with wheat which is immune to the rust-fungus, seems very probable. The hypothesis is that, in the attack of immune wheat plants by rust, the tissue is immediately killed. The fungus, being an obligate parasite, cannot live in the dead host tissues and so dies. Applying the analogy to self-sterility, the self-pollen tube is in a better medium for food assimilation, and therefore does not grow so quickly as a cross-pollen tube where the medium is less suitable to it. The cross-pollen tube is assumed to continue growth in order to obtain a better food supply.

It thus seems that the greater width of the self-pollinated pollen tube is due to the fact that the food supply is more favourable to the nourishment of a self-pollen tube than it is to a cross-pollen tube. On account of the abundant food supply the pollen tubes did not lengthen, but grew wide since they were in such a favourable medium. By this hypothesis it is possible to explain most of the above data with regard to self-sterility and it is not contrary to any cytological evidence.

1011 - The Behaviour of the Hybrids *Avena sativa patula* var. *Victor* × *Avena sativa nuda* var. *inermis*. — ZINN, JACOB, and SURFACE, M. TRAM in *Journal of Agricultural Research*, Vol. X, No. 6, pp. 293-312, Plates 3-17. Washington, 1917.

This paper contains a description of the F_1 and F_2 generations of a cross between two subspecies of oats which possess several contrasting characters: *Avena sativa patula* var. *Victor* and *Avena sativa nuda* var. *inermis*. The first of these is characterised by the presence of flowering glumes (*lemmae*) which adhere closely to the caryopsis ("hulled grain"), by the biflorous spikelets, black colour of the glumes, strong awns, and a long, but rather sparse, pubescence at the sides of the base of the lower grain.

Avena sativa nuda var. *inermis* has, on the contrary, the following characteristics, loose, membranous and detached glumes; multiflorous spikelets; white or light yellow glume colour; almost total absence of awns, and absence of pubescence at the base of the grain.

The F_1 generation is distinctly intermediate. In regard to the glume both naked and firmly hulled grain, as well as intermediate forms, are found in the same panicle, and even in the same spikelet. The spikelets near the top of the panicle are either entirely naked, or nearly so, while those spikelets at the base tend to be firmly hulled.

Regarding the inheritance of grain colour, there are some black and some yellow individuals, in the ratio as 3 : 1, the black pigment thus being dominant.

In the F_2 generation, in addition to the two parental types (naked and hulled), 4 intermediate classes with an evidently heterozygous character were distinguished. The different forms present a simple Mendelian relation of 1 : 2 : 1

Segregation in regard to hull character.

	Hulled	Intermediate	Naked
Observed	221	404	229
Expected	213.5	426	213.5

There is thus a good agreement between the observed and expected results.

The same is the case as regards the grain colour; here black is dominant in relation to white as the following data show:

Observed	Black : White = 646 : 208
Expected	Black : White = 646.5 : 213.5

The ratio between the black and the white individuals is thus as 3 : 1.

There is no correlation between the determinants of hull character and the grain colour. The ratio between the black and white individuals always remains the same in the hulled, intermediate and hull-less grain. This is clearly shown by the following table:

	Hulled		Intermediate		Hull-less	
	Black	White	Black	White	Black	White
Observed	190	55	296	108	184	45
Expected	190.1	53.1	320.3	100.5	100.1	53.4
Ratio	3	1	3	1	3	1

As regards the pubescence at the base of the grain, this character is sometimes much more developed in some of the F_1 hybrids than in the parent *Avena sativa patula* var. *victor*. The writer explains this fact by assuming that the character of complete pubescence is due to the action of 2 factors, A and T; the first, A, which belongs to *Avena sativa patula*, gives a slight, thin pubescence; the second, T, which is present in *Avena sativa nuda*, has no effect by itself, but in conjunction with A, it determines a higher degree of pubescence with a maximum in individuals homozygous for A and T.

Composition of F_2 Hybrids

		Male Gametes of F_1			
		AA	AT	TA	TT
Female Gametes of F_1	AA	AA AA	AT AA	TA AA	TT AA
	AT	AA AT	AT AT	TA AT	TT AT
	TA	AA TA	AT TA	TA TA	TT TA
	TT	AA TT	AT TT	TA TT	TT TT
		Zygotes of F_2			

The F_1 hybrid, which has the formula A A T T, produces 4 kinds of gametes: A A A T T A T T, which, in F_2 , may give 16 combinations (see Table). Among these, one only, T T T T, is completely free from pubescence; all the others, in fact, have a factor A. Out of 323 F_2 individuals, 300 were pubescent and 23 smooth (theoretically: 302.8 and 20.2), according to the ratio 15:1

There is no correlation between the colour of the grain and the pubescence at the base of the grain.

The quantity and quality (weak and little developed, strong and much developed) of the awns in crossing experiments depend, not only on the presence of special determinants, but also on the morphological constitution of the lower flowering glumes. In naked forms (where the glume does not adhere to the grain) with membranous flowering glumes, the awned character can only appear when the determinant is present. Taking only the types of hulled grain and intermediate hulled grain, the ratio of strong awned and of weak awned plants is as 3:1 (observed 245:77; expected 241.5:80)

1012 - Hybrids of *Zea Ramosa* and *Zea tunicata*; Experiments Carried out in the United States. — COLLINS, G. N., in *Journal of Agricultural Research*, Vol. IX, No. 11, pp. 333-395. Bibliography of 9 Publications. 3 plates. Washington, June 1917.

Zea ramosa and *Zea tunicata*, both resulting by mutation from *Zea Mays*, are probably reversions from normal maize toward the general type of grasses, since they have lost the specialization that distinguishes maize from practically all other Gramineae. The writer crossed these two mutants in order to determine the nature and behaviour of their characters, with

hope that their combination might bring to light still other and latent central characters and help to give him a more definite conception of ancestors and history of cultivated maize.

The following is a summary of the distinctive characters of the two plants which were the subjects of the experiment:

I. — *Zea ramosa*: 1) The female inflorescence is not simple, but compound and branched like the male.

2) In normal maize, the terminal male inflorescence bears a number of branches at its base. Above the uppermost branch the axis is continued, and then an abrupt transition into the central spike. In the *Z. ramosa* tassel, the branches are much more numerous and gradually decrease in size from the base upwards, the transition from branches to pairs of spikelets being perceptibly gradual. *Zea ramosa* is a recessive variation, with the appearance of normal maize.

II. — *Zea tunicata*: The glumes of the female inflorescences are developed so that each seed is either completely, or nearly, inclosed; the seed is thus tunicate. The progeny in self-pollinated plants are separable into 2 classes:

Type *a* (*Zea tunicata a*), like the female parent, with typical tunicate seeds and thickened tassels;

Type *b* (*Zea tunicata b*), with greatly enlarged tassels containing both staminate and pistillate flowers, and with the ear either aborted, or bearing greatly enlarged and usually sterile spikelets.

The ratio of the 2 types *a* and *b* is as $\frac{2}{3} : \frac{1}{3}$.

The *tunicata* type *b* represents the original homozygous form, while *tunicata a* represents the heterozygous form, a cross between normal maize and type *b*.

In 1914, at Lanham, the writer crossed *Zea ramosa* with *Zea tunicata* and obtained (1915) 9 plants in the F_1 . Of these, 4 were tunicate, and 5 normal, with no trace of the *ramosa* characters. The *tunicata* type is clearly heterozygous. From 3 tunicate ears 326 plants were obtained by self-pollination (in 1916) in the F_2 , and from 2 ears of the normal type, plants were raised.

The characters of these hybrids of the F_2 were as follows:

The 82 plants from the normal type were divided into 2 groups: 65 normal and 17 *ramosa*, in the ratio of 3:1.

The 326 plants obtained from the tunicate ears represented a completely homogeneous mixture of the characters of the 2 parents, but 5 types could be distinguished: 1) normal; 2) *tunicata a*; 3) *tunicata b*; 4) *ramosa*; 5) *tunicata ramosa*. In the last group, some individuals presented an entirely new type of inflorescence, where the tissues were still in an embryonic condition and continued dividing; so that the ramifications continued on being produced throughout the growing season, the result being a dense succulent mass without any trace of floral or foliar organs.

The writer explains the numbers in which the various classes of plants appear by the assumption of a comparatively simple gametic composition, and gives the following formulae:

TABLE I. — Possible combinations in the F_2 of the hybrid between *Zea tunicata* and *Zea ramosa*.

		Male gametes of the F_1			
		TR	TR'	T'R	T'R'
Female gametes of F_1	TR	TR tunicata b	TR' tunicata b	T'R tunicata a	T'R' tunicata a
	TR'	TR tunicata b	TR' tunicata-ramosa	T'R tunicata a	T'R' tunicata-ramosa
	T'R	TR tunicata a	TR' tunicata a	T'R normal	T'R normal
	T'R'	TR tunicata a	TR' tunicata-ramosa	T'R normal	T'R' ramosa
Zygotes of F_2					

TABLE II. — Composition of the F_2 of the hybrid between *Zea tunicata* and *Zea ramosa*.

Number expected of each 16	Gamete Composition	Characters of plant	Expected Number	Observed Number
1	T'T'RR	normal	1	01.2
2	TT'RR'	"	2	
2	TT'RR	tunicata a	2	122.0
4	TT'RR'	"	4	
1	TTRR	tunicata b	1	01.2
2	TT'RR'	"	2	
1	TT'R'R'	tunicata-ramosa	1	01.2
2	TT'R'R	"	2	
1	T'T'R'R'	ramosa	1	20.4
Total 16			326.0	

To *Zea tunicata b*, may be assigned the formula TTRR , where T = the determinate factor, and R = the inhibiting factor which prevents the appearance of the characters of *Z. ramosa*.

The formula assigned to *Zea ramosa* would then be T'T'R'R' , where T' = the absence of the determinant T , and R' = the absence of the inhibiting factor R . The formula for *Zea Mays* would be T'T'RR . For *Zea tunicata a* (*Zea tunicata* \times *Zea Mays*), formula T'T'RR .

From the cross *Zea tunicata a* \times *Z. ramosa* (made by the writer in 1914), there should be obtained 2 types of plants: T'T'RR' and T'T'RR' , neither being of the *ramosa* type on account of the presence of R .

The hybrid T'T'RR' , having the characters of ordinary maize, produces kinds of gametes: T'R and T'R' , which give, in the F_2 , 4 combinations: $\text{RTR} - \text{T'R'T'R} - \text{T'R'T'R'} - \text{T'R'T'R'}$ - of which the 3 first are normal (ordinary type) and the last is the *ramosa* type.

The hybrid T'T'RR' (*tunicata a*) will give, on the contrary, 4 different gametes - $\text{TR} - \text{T'R} - \text{TR'} - \text{T'R'}$ - and, in the F_2 , 16 different combinations (see Table I). All the plants either heterozygous or homozygous for R and homozygous for T would be normal. All plants homozygous for R' would be *ramosa*. Those heterozygous for T , and with at least one R , would be half tunicate (*tunicata a*). Those homozygous for T , and with at least 1 R , would be full *tunicata* (*tunicata b*).

In Table II, the 326 individuals of the F_2 obtained in 1916 (self-pollinated ears of the type *tunicata a*) are divided into different categories. Next the expected numbers are placed the observed numbers; the two values respond almost exactly.

The writer had hoped in the course of his experiments to be able to individualise and define new ancestral characters which would enable him to reconstruct the original ancestor of cultivated maize, but from this point of view the results were negative; for the hybrids only showed a completely heterogeneous mixture of the *ramosa* and *tunicata* characters, and no phylogenetic value could be attributed to the grotesque inflorescences, mere monstrosities, mentioned above. The writer's careful experiments, however, allow us to form a clear idea of the nature of the two mutants, the one, *ramosa*, recessive, the other, *tunicata*, dominant, as compared with the normal type. The result of crossing these two mutants has not shown that both behave as independent Mendelian units according to the hypothesis put forward by the writer and corresponding exactly to the conditions observed in the course of the experiments.

1913: The Colour of the Seed in the Descendants of a Natural Hybrid of Two Varieties of *Phaseolus vulgaris*, in Sweden. - LUNDBERG, JOHN and AXELMAN, A., in *Swedish Lidskiftsberättelse*, Year XXVII. 1913, pp. 115-121. Malmö, 1917.

Among the descendants of a pure line of dwarf beans with chocolate coloured seed (isolated from a plot of the "Prinzess" variety with yellow-brown seeds) there was noticed, in 1913, a plant which was distinguished by dark brown colour. From this plant, clearly a heterozygote, 3 different types were obtained in 1914, namely:

- 6 individuals with dark brown seeds, like the parent plant,
- 4 individuals with yellow-brown seeds, like the original variety.
- 1 individual with chocolate coloured seeds.

In the following generations, F_2 (1915) and F_3 (1916), these characters were carefully studied in order to ascertain whether they remained constant or broke up into two or more groups in accordance with constant numerical ratios.

The principal results of these investigations may be summarised as follows:

1) The dark brown colour of the seeds of the mother plant remains constant in some of the descendants, but in the others it breaks up into

- a) dark brown and chocolate colour, or
- b) dark brown and yellow-brown, or
- c) dark brown, chocolate colour, yellow-brown and yellowish-white.

2) In plants with chocolate colour seeds, this character is either preserved, or else it breaks up into chocolate colour and yellowish-white, but individuals with dark yellow seeds are never produced.

3) The dark yellow colour either remains constant or splits up into yellow-brown and yellowish-white, according to the ratio 3 : 1.

4) The yellowish-white colour remains constant.

The author explains these phenomena by the existence of two determinants, U for the yellow-brown (characteristic of the "Prinzess" variety) epistatic for the yellowish-white substratum, and C for the chocolate colour. The gametic composition of the various types when homozygotic should therefore, be:

- $CCUU$ dark brown seeds.
- $CCgg$ chocolate colour seeds.
- $ccUU$ yellow-brown seeds.
- $ccgg$ yellowish-white seeds.

If $ccUU$ is crossed with $CCgg$, the hybrids of the 1st. generation will have the formula $CcUg$ (this was the case with the dark brown seeds isolated in 1913). In the 2nd. generation, as may be seen from the appended diagram, there may be four types: 1) with dark brown seed; 2) with chocolate colour seed; 3) with yellow-brown seed; 4) with yellowish-white seed; in the ratio 9 : 3 : 3 : 1. In reality, the yellowish-white type is absent, on account of the few plants studied and the rareness of the combination $ccgg$.

Diagram of the various gametic combinations possible in F_2 .

Male gametes of F_1

♀ ♂	Male gametes of F_1				Zygotes of F_2
	Cd	Cg	cd	cg	
Cd	CC dd dark brown	CC Dg dark brown	Cc dd dark brown	Cc Dg dark brown	
Cg	CC Dg dark brown	CC gg chocolate colour	Cc Dg dark brown	Cc gg chocolate colour	
cd	Cc dd dark brown	Cc Dg dark brown	cc dd yellow-brown	cc Dg yellow-brown	
cg	Cc Dg dark brown	Cc gg chocolate colour	cc Dg yellow-brown	cc gg yellowish-white	

Zygotes of F_2

4 - The Effects of Age on the Hybridisation of *Pisum sativum*: Researches in Austria. — ZEDERBAUER, E., in *Zeitschrift für Pflanzenzüchtung*, Vol. V, Pt. 2, pp. 257-259, Berlin, 1917.

Two varieties of peas were used in this experiment: 1) "Wunder von America" with green, wrinkled, angular seed; 2) "Auslös de grâce", with flow, smooth, round seed. Plants of different ages were crossed by fertilising the first flower of a "Wunder von America" with the pollen of the 1st flower (the oldest) of an "Auslös de grâce". Four wrinkled, angular seeds of a greenish-yellow colour were obtained, showing predominance the characters of the mother plant. This is also observed in the F_2 and generations, as may be seen from Table I.

TABLE I. — Cross between individuals of different ages. Characters of the seeds and their distribution in F_2 and F_3 .

	Yellow seeds	Greenish-yellow seeds	Green seeds	Green seeds with yellow spots	Smooth seeds	Pale-yellow seeds	Wrinkled seeds
Number of seeds:							
in F_2	0	0	194	30	0	0	224
in F_3	5	419	6590	503	33	16	7468
Percentages:							
in F_2	0%	0%	86.3%	13.7%	0%	0%	100%
in F_3	0.1	5.6	87.6	6.7	0.5	0.2	99.3

The 7517 seeds of the 3rd. generation were all indistinctly angular; 32 were green and smooth; 4 were yellow and wrinkled; 1 only was yellow and smooth. The dominance of the maternal group of green, wrinkled seeds is, therefore, evident.

If, however, individuals of equal ages (first flower of both parents) are crossed, the results given in Table II are obtained.

TABLE II. -- Cross between individuals of equal ages. Characters of the F_2 and their distribution in F_2 and F_3 .

	Yellow seeds	Greenish-yellow seeds	Green seeds	Smooth seeds	Wrinkle seeds
<i>Number of seeds:</i>					
in F_2	120	2	31	106	47
in F_3	1 008	—	541	1 039	618
<i>Percentages:</i>					
in F_2	79 %	1 %	20 %	70 %	36
in F_3	61	—	36	67	35

Table II shows that, in this case, the paternal characters (smooth, low seeds) become dominant.

The age of the individual, therefore, has a quite definite influence on the phenomena of hybridisation. The characters of young individuals usually recessive, tend, when crossed with an older one, to assert themselves gradually more and more till, finally, they become completely dominant.

1015 - The Improvement of Native Vines by Crossing and Selection in the United States. -- DEARING, CHARLES, in the *Journal of Heredity*, Vol. VIII, No. 9, pp. 412-4, fig. 10-18, Washington, D. C., 1917.

In the South East region, lying between the slopes of the Appalachian Mts. and the Atlantic Ocean, cultivated varieties of *Vitis vinifera* will not grow, on account of the want of soil drainage, and the moisture and excessive heat. The only vines that succeed are some types of native vine known under the generic name of "Muscadine Grape" and belonging to the two species *V. rotundifolia* and *V. Munsoniana*. In addition to the adaptation to the climate and unfavourable conditions of their environment, these vines are also distinguished by the following characters:

- 1) Vigorous growth, and special resistance to diseases and insect
- 2) late and prolonged blooming season which insures a regular crop at uniform yield; 3) productive period of 100 years, or even longer.

On the other hand, however, these vines have small bunches, the fruit has a low sugar content, the pips are large, and what is of more importance the plants are dioecious, which reduces the percentage of fruit set. With a view to improving the production of grapes used for wine-making and for the table in North Georgia and the neighbouring zones, the Bureau of Plant Industry of the Department of Agriculture of the United States

undertook a series of experiments and investigations in the vineyards belonging to the Willard (N. C.) Agricultural Experiment Station. The results hitherto obtained have been most promising. The object of these studies was twofold: 1) to improve, by means of crossing and suitable selection, the cultivated kinds of *Muscadinia*, and to eliminate undesirable characters; 2) to try to cross *Muscadinia* with *Vitis vinifera*, with the intention of uniting in a single type the excellent qualities of *V. Vinifera* and the resistance of the native vines to bad climatic conditions.

A. — IMPROVEMENT OF NATIVE VINES. One of the most striking results has been the creation of self-pollinating kinds with complete, hermaphrodite flowers which allow of a type with well-known fruit characters being multiplied without any recourse to a male plant of which the fruit characters are necessarily unproved. The introduction of self-pollinating types presents additional advantages: a) a perceptible increase in the percentage of fruits set, this being from 25 to 50 per cent., while in the case of self-pollinated varieties, the maximum is given by "Flowers" with 15 per cent.; b) the elimination from the vineyards of male vines which take up space without producing any grapes; c) a considerable increase in the size of the bunches; all these improvements increase the yield.

The two original hermaphrodites H_1 and H_2 were produced, the first at New-Smyrna, Florida, by crossing the "Eden" variety (a "Muscadinia") with a wild individual of *V. Munsoniana* bearing coloured grapes of a dark blue, and the second, at Medoc Vineyard, Enfield, N. C., by crossing "Scuppernong" with a wild male plant with white (colourless) fruit.

B. — CROSSING EXPERIMENTS WITH *Vitis vinifera*. As regards the hybrids actually obtained, since the plants have not yet borne grapes, little can be predicted concerning their practical utility. However, stress should be laid upon the great scientific importance of this work in which very serious technical difficulties have been overcome, and which has resulted in the union in a single individual of two "uncongenial" groups like *Euvitis* and *Muscadinia*. The hybrid nature of the offspring is proved by the presence of two types of botanical characters, as is shown by the examination of the tendrils, these being simple in *Muscadinia*, and bifurcated in *Euvitis*; while in the hybrids, we meet with simple and annulated tendrils on the same individual at the same time.

The kind of *Muscadinia* which most resembles *V. vinifera* is, without doubt, the Thomas variety. The latter can be fairly easily crossed with *Roditis*, *Carignan*, and *Noah*, and produces stable, vigorous hybrids. Of the other vines of the *Euvitis* group that have been used with success, we should mention; Winchell, Olivette de Vendemain, Merveille de Malaga, Muscat d'Alexandrie, Calabrese, Ferrara, Sémillon, White Hanepoot, Prune de Cazouls, Huasco, Goethe, Brillant, Catawba, Iona and Ives.

The hybrids in question have not yet borne fruit, nevertheless, we may confidently expect that the introduction of the elements of *Euvitis* will bring about a considerable improvement in the native vines, if only as far as the

increase in sugar content is concerned. In selection and acclimatisation work, it is primarily necessary to try to unite in one subject the characters of the superior strains with the capacity of local varieties to resist unfavourable, or not especially good, environmental conditions. From this standpoint, *Muscadinia* \times *Euvitis* will be a considerable advance in the creation of good industrial types which can thrive in the damp, warm regions of the South-East. Some other wild varieties of *Vitis* growing in the various regions of the United States have already furnished material for similar attempts and experiments. We may mention: *Vitis aestivalis* (summer grape) which is particularly adapted to the high, hot and more or less arid regions of Texas and Missouri; *V. riparis* (river bank grape), suitable for alluvial soil; *V. Labrusca* (north-eastern fox-grape), which flourishes in the states and regions of the North-East.

By pollinating the flowers of female vines with pollen taken from hermaphrodite flowers, mixed offspring of young female and hermaphrodite flower are obtained, with the almost entire exclusion of male types. By means of continuous work in this direction, it is possible to create, for each of the varieties most in vogue, the perfect hermaphrodite type. This has been the case with James, Scuppernong, Thomas, Eden and Flowers.

The gradual increase in productivity in the course of the work is due to 3 orders of facts: 1) Continuous selection of the most productive individuals; 2) the occurrence of hermaphrodite types with an increased percentage of fruit set; 3) the creation of new kinds with more developed female or hermaphrodite, inflorescences. The chances of insect-pollination increase with the size of the inflorescences. The low productivity of Scuppernong, which ought, on the contrary, to be the variety most prized for the quality of its grapes, is evidently due to the small size of the bunches, as is seen on examining the following table:

Kind of muscadine grape	Number of flowers per inflorescence	Number of grapes per ripe bunch	Percentage of fruit set under natural conditions
Scuppernong	23.8	2.5	4.01%
James	28.0	4.7	13.36%
Thomas	30.3	5.4	16.32%
Flowers	40.3	5.1	15.10%

The hermaphrodite types are distinguished, not only for their self-pollinating, but for the great development of their inflorescences, which secures their entire superiority over types of a dioecious nature.

The hybridisation attempts made for the purpose of improving some of the grape characters gave satisfactory results which may be summarised as follows:

1) *Adherence of grape to peduncle*: one of the chief defects of Scuppernong and Thomas is that the grape is much more easily detached from the peduncle; this allows some of the juice to escape, thus soiling the other grapes

promoting the growth of moulds. By crossing the above-mentioned varieties with Flowers, a variety characterised by the firm adherence of the grape to the development of the fibro-vascular bundles, it is possible to unite in a single type the qualities of Scuppernong and Thomas with the firm adherence of Flowers; 2) Increase in the sugar content and decrease of the acids in the juice; 3) An improvement in the quality of the pulp of the grapes; 4) Greater uniformity in ripening.

160 - *Wheat Production in the Argentine* (1), — GIROLA, CARLOS D. (Honorary Director of the Agricultural Museum of the Argentine Rural Society), *El Cultivo del trigo en Argentina*, Publicación del Museo Agrícola, pp. 31, figs. 22. Buenos-Aires, 1917.

This pamphlet contains popular instructions for the use of farmers, together with observations and data collected by the Author.

Wheat in Argentine covers an area of about 16 to 17 $\frac{1}{4}$ millions of acres. These are found almost exclusively in the so-called "grain district", which includes the provinces of Buenos Aires, Córdoba, Santa Fé, Entre-Ríos, San Luis, and the National Pampa Territory. It could, however, be grown much more widely, for the soil of the Provinces of Mendoza, San Juan, La Rioja, Catamarca, etc., and the districts of Rio Negro, Neuquen Chubut are well suited to it.

The varieties most commonly grown are:

BEARDED SOFT WHEATS: Barletta; Hungarian; Italian or Lombard; Russian; Rieti; Canese; Saldomé; Piedmontese.

BEARDESS SOFT WHEATS: Russian beardless; French or Bordeaux; Touzella.

HARD WHEATS: Candell; Taganroch; and, much less, Medeah and « Español de grano rojo ».

Japanese wheat is remarkable for its adaptation to soils exhausted by repeated crops of cereals or other plants and by its resistance to drought, but its grain is small.

As a rule wheat is not manured in the Argentine. The average quantity of seed used is 62 $\frac{1}{2}$ lbs. per acre; the average annual production in normal years is 12 cwt. per acre. The cost of production varies between 3 s. 8 d. and 4 s. 7 d. per cwt.

The diseases to which wheat is most subject in the Argentine are: common rust or "polvillo del trigo" (*Puccinia graminis*); bunt (*Tilletia Tricoci* [*T. Caries*], *T. levis*); smut or "carbón" (*Ustilago Tritici*); straw blight or "mal del pie" (*Ophiobolus graminis*).

The insect pests are: — ants; locusts; "isoca común" (*Leucania bipuncta*); "gusano blanco" (larvae of *Diloboderus abderus*); "palomita" or "alucita" (*Alucita cerealella* = *Sitotroga cerealella*); corn weevil or "gorgojo" (*Calandra granaria*); "gusano blanco" (*Trogosita mauri-nica*), etc.

The figures included in the paper illustrate the best varieties of Argentine wheat and the machines generally used for the extensive cultivation of cereals.

(1) See also the original article: CARLOS GIROLA, *The Principal Varieties of Wheat grown in the Argentine Republic*, in *B. 1915*, p. 895-899. (Ed.)

1017 - Observations on Manitoba Wheat in Algeria in 1917. — THE BROTHERS GAY
Bulletin Agricole de l'Algérie-Tunisie-Maroc, 2nd. Series, Year 23, No. 9, pp. 181-2
 Algiers, September, 1917.

The following observations were made by the brothers GAY on the cultivation of Manitoba wheat at Berrouaghia (Algeria) in 1917.

Date of sowing: 3rd. April, 1917; area sown: $15\frac{1}{2}$ acres; quantity of grain sown 1045 lbs.; date of harvest: 27th. July; yield of grain: 952 cwt.; weight per bushel: 69 lb.

The wheat was broadcast in a very wet, clay loam, about 67 lb. of grain per acre being used. The grain used was neither very fine nor uniform.

In spite of very unfavourable climatic conditions (particularly violent and continuous sirocco during the flowering and ripening) the 1045 lb. of Manitoba wheat sown gave a yield of 952 cwt. of grain. This result of great interest when compared with the yield of native wheat, and when account is taken of the lateness of sowing (the seed only reached Algiers on the 23rd. March) in the Berrouaghia district, where the climate changes suddenly from very hot to very cold.

1018 - Composition and Food Value of *Andropogon tener*; Investigations in Brazil. — D'UTRA, G., in *Secretaria da Agricultura, Commercio y Obras Públicas do Estado de São Paulo, Boletim de Agricultura*, 18th. Series, No. 6, pp. 374-376. São Paulo, June 1917.

Andropogon tener Kunth. (syn.: *A. campestris* Kunth. and *A. Nees* Trin.) grows wild in many states of Brazil (São Paulo, Minas Geraes, Rio de Janeiro), where it is used not only as pasture, but also as litter and for stuffing mattresses. As the culms and leaves are very thin they are easily made into hay. The plant, being very fibrous, has not a great feeding value. This has been confirmed by analyses, made by the Agricultural Institute of the State of São Paulo, of samples from Itararé. The results obtained are given below.

Composition and Food Value of Andropogon tener.

	In the fresh material	In the dry material
1) General analysis:		
Moisture	45.39 %	—
Nitrogen	2.71	4.96 %
Fat	1.03	1.83
Nitrogen-free extract	27.71	50.75
Fibre	20.42	37.39
Ash	2.74	5.02
2) Digestible matter:		
Nitrogen	1.90 %	3.47 %
Fat	0.67	1.22
Nitrogen-free extract	21.89	40.99
Fibre	14.00	25.79
Organic matter	48.55	70.57
Nutritive ratio		1 : 12.5

Composition of ash:

Sand and silicic acid	75.76 %
Phosphoric acid	1.50
Potassium oxide	12.66
Calcium oxide	4.01

259 - *Panicum racemosum*, a Wild Forage Plant of Brazil. — DA SILVA LUIZ, in *Sociedade da Agricultura, Commercio y Obras Públicas do Estado de São Paulo, Boletim de Agricultura*, 18th. Series, No. 6, p. 451. São Paulo, June 1917.

Panicum racemosum Spreng (syn. *P. reptans* Kunth.) grows wild in Brazil in the States of São Paulo and Rio de Janeiro, in the Antilles, where it is known as "grana de Castilla", in Uruguay, near Montevideo. In Brazil the plant does not appear to have any special popular name, but is known as "capim", the same given to forage Gramineae in general. All kinds of live-stock eat it, and it grows in the meadows and along the road-sides. When in full flower it reaches a height of 27 ½ inches. Its cultivation in the state of São Paulo is advised.

6 - *Hedychium coronarium* in Brazil (1). — BEADLE, CLAYTON, in *Royal Botanic Gardens, Kew, Bulletin of Miscellaneous Information*, No. 3., pp. 104-105. London, 1917.

The writer recently undertook a journey to Brazil to see the extent which *Hedychium coronarium* has been established there and also to investigate the possibilities of using it for paper-making in that country and elsewhere. He found that the plant is fairly well-known in certain low-lying lands in the State of Rio Janeiro, although not particularly abundant. In the neighbourhood of the town of Rio Janeiro itself, the writer procured specimens which grew to a height of 10 or 12 feet. The district where *Hedychium* is especially plentiful is in the low-lying lands in the State of Paraná, the most abundant supplies being centred round Morretes. In this district, *Hedychium* grows along the railway line which winds up to Curitiba to an elevation of at least 1000 ft. The size of the plant seems to diminish as one rises, until it disappears altogether at an elevation of 1500 ft. Its normal height in the regions of the plains is about 5 ft. *Hedychium* seems to grow most vigorously after the ground is burnt over to clear it for sugar-cane.

Experiments with a view to its cultivation in the State of Rio, particularly on land that has been cleared and used for sugar-cane, show very promising results. The plant grows strongly all the year, and the ground underneath is more or less choked with the débris of dead stems. The writer did not see any *Hedychium* in his journey through the most southerly part of Brazil, in Uruguay, Argentina, and up the Chilian and Peruvian Coasts.

He extracted the fibre from the green plant by mechanical means, imitating methods that would be employed in the preparation of the fibre for textile purposes, and came to the conclusion that a far whiter fibre may be extracted than has hitherto been obtained, by taking fairly simple precautions.

(1) See also: *B.* 1913, No. 310; *B.* 1915, No. 135; *R.* 1916, No. 260.

1041 - **Indigo Cultivation in Honduras.** — DYER, F. J., in *Commerce Reports*, No. 206, p. 761, Washington, D. C., Sept 4, 1917.

The war-time demand for dyestuffs has revived the ancient indigo industry of Central America. Honduras had never wholly abandoned the cultivation of indigo, for although it ceased to yield a profit as an export product, in competition with the synthetic output of commercial laboratories, it is still found in general domestic use among the people. The processes are crude, however, but if the industry could be assured of a satisfactory future, improvement would be feasible.

The centre of the indigo industry in Honduras is around Camasca which is in the southern portion of the Republic, close to the border of Salvador. The product is marketed in Salvador, and does not show in the export returns of Honduras. The acreage in indigo around Camasca had increased from 1 367 manzanas in 1916, to 3 585 manzanas in 1917 (manzana = 1.72 acres). The production, even with the primitive methods of cultivation and extraction in use, is about 30 pounds of indigo per manzana so that the output of this small district should approximate 100 000 pounds for 1917.

1022 - **Cassia Tora, a New Coffee Adulterant Examined at Poona, British India.** — TAMHANE, V. A., in *The Poona Agricultural College Magazine*, Vol. IX, No. 1, pp. 4-5, Poona, July 1917.

A number of samples have recently been received in the Laboratory of the Agricultural Chemist, Bombay, Poona, under the names of "artificial coffee", "swadeshi coffee", "coffee substitute", etc. These were sent for analysis and report as to whether they were nutritious and harmless. Microscopic examination revealed that the samples were obtained by roasting and crushing the seeds of *Cassia Tora* (called "takla" locally and "kavadia" in Gujarati) which is a shrub commonly found in the fields in the province of Bombay, where it grows to the height of 1 to 3 ft. This substitute for coffee has the appearance of ground roasted coffee; the aroma however, is not quite the same. The drink made from the seeds of *Cassia Tora*, though differing in taste from true coffee, is not unpleasant. The ether extract contains the glucoside emodin ($C_{15}H_{10}O_6$) of which the true nature is not fully known, but it is supposed to be harmless. The chemical composition of the roasted seed of *Cassia Tora* is as follows:

Composition of Roasted Seed of Cassia Tora.

	%
Water	6.45
Ether Extract	5.25
Albuminoids	20.00
Soluble Carbohydrates	49.05
Woody Fibre	11.05
Ash	5.20
	<hr/> 100.00

3 - Adulteration of Seeds of *Illicium anisatum* with those of *Illicium religiosum* and Cases of Poisoning Due to the Use of the Latter, in the Philippines. — See No. 989 of this Review.

4 - The Cultivation of Pepper-Vines at Banka, Dutch-East-Indies. — See No. 1083 of this Review.

5 - Experiments on the Manuring of Tobacco Plantations, in Java. — BEETS, A. N. J., in *Proefstation voor Vorstenlandsche Tabak, Mededeeling No. XXVIII*, pp. 43-50. Semarang, 1917.

The difficulty of obtaining sufficient quantities of potassium sulphate led the author to undertake experiments with a view to replacing this fertiliser by potassium silicate and the double sulphate of potassium and magnesium. The first contained 10.9 % of soluble potassium, and the other 22.6 %. The chlorine content was 2.75 %.

The experiments were carried out in soil in which the advantage of basic manures had been proved by previous tests. A fertiliser composed of sulphate of ammonia, double superphosphate and potassium phosphate gave satisfactory results. The substitution of potassium silicate for potassium sulphate was also satisfactory. Still better results were obtained by substitution of double sulphate of potassium and magnesium for potassium sulphate. The author points out, however, that the action of the mine in this fertiliser may affect the burning qualities of the tobacco.

6 - Observations on some Direct Bearers, in France. — DUBREUIL, L., in *Le Progrès agricole et viticole*, Year 34, No. 37, pp. 265-266. Montpellier, September 16, 1917.

The years 1915 and 1917 were very disastrous to wine-growing, and for this reason contributed largely to the success, the development and selection of hybrid direct bearers.

The author, wishing to see for himself the results obtained from the hybrids, visited vineyards in different districts of France, and summarises in this paper, his personal ideas and observations.

The high prices commanded by the produce of fine *Vinifera* plants, and the large outlay for obtaining them, this outlay often including large expenses incurred in controlling fungous disease.

Thanks to its abundant yield Aramon is almost sure to survive, especially in the fertile plains, where great expense may be risked as there is an almost complete certainty of obtaining, at least every two or three years, a harvest which will compensate for the losses of bad seasons.

Where plants of average yield subject to disease are concerned, a new tendency may be noted. This tendency consists in setting apart in numerous districts, if not everywhere, a fairly large area for direct bearers, so as to have a sort of "insurance against bad seasons". This seems a wise step in so long as it is not carried to excess.

No hybrid is *completely immune* to mildew, but many are *practically immune* or easily protected.

A small number of hybrids are described which proved very interesting, especially in 1915 and 1917.

In the south of France, Couderc 71-20 (or 7120) leads by a long way. On an estate at Fréjus (Var), many acres are given up to these vines, not from 5 to 8 years old. Their growth leaves nothing to be desired, and the plants, which are surrounded by vineyards ravaged by mildew, are in excellent condition. When closely examined fairly numerous spots of mildew are found on the leaves, but more of them have fallen, and the harvest is intact and very strong without having had any copper treatment. The sole defect of 7120 is that it ripens rather late, and could hardly be grown outside the Mediterranean basin.

On the same estate Seibel 1020 gave every satisfaction after having been twice sprayed.

In an experimental vineyard near Arles excellent results were obtained with 7120 and other plants, such as Couderc 106-46 (which could be recommended if its wood lignified), Seibel 156 (whose leaves only require 2 or 3 treatments with copper), 1020, etc.

In another experimental vineyard at Cosne (Nièvre), where the soil is stony and contains 49 % of lime, the plants which did best were the following:

Jurie 580, tall plants, fine growth, good harvest; rather late.

Oberlin 595 (Gamay \times Riparia), tall plants, very early, moderate yield.

Oberlin 605, tall plants, more productive than the preceding one.

Pink Seibel 28-59, early, follows soon after Chasselas.

Couderc mixed hybrid (Couderc 1:9-88 \times Sauvignon du Cler), seems very good.

In soils containing little lime in this district the following plants are best: Seibel 2003, 1000, 1020, 254 and 2524; Jardin 501 Couderc (the plants); Oberlin 595 and 605. Jurie 580.

In soils containing a great deal of lime, Oberlin 595 and 605 do best. Next to this experimental vineyard is a Noah vine, which, although many of its leaves are attacked by mildew and a few seeds by brown rot, is practically immune and bears a fine harvest.

1027 - The Improvement of the Native Vines of the United States by Selection and Hybridisation. — See No. 1025 of this Review.

1028 - The Nettle Tree, Considered from the Points of View of Forestry, Food and Industry. — DEGLI ATTORI M. (Istituto delle Industrie Agrarie e R. Oleificio Sperimentale annesso alla R. Scuola Superiore di Agricoltura in Portici, 1914), in *Annali della R. Scuola Superiore di Agricoltura in Portici*, 2nd Series, Vol. XIII, pp. 1-27. Portici, 1914.

The nettle-tree (*Urtica australis* L., family Urticaceae) is one of the best trees for replanting forests because of its rapid growth, even in poor and red soils. The value of its products (wood, leaves and fruit) soon compensates for the expenses incurred in planting and cultivating it.

In the temperate zone, to which it is best suited, the nettle tree does well in any exposure and in any soil. Its different ways of propagation allow the grower to choose the method of planting which is best adapted to the local conditions and the soil. The tree does well in soils where other trees grow only with difficulty, and helps to cover rocky and arid ground.

When grown on the pollarding system or in groups of coppice shoots, it supplies material for the manufacture of many implements, chiefly agricultural. Each part of the tree is of value and supplies useful material; thus; the wood, by reason of its hardness, fine grain, delicate colour, elasticity and resistance, is excellent for turning or cabinet-making, the leaves are valuable as fodder for animals, especially in seasons and districts in which there is a shortage of green fodder; cattle and goats willingly eat the young leaves which, when fresh, contain 6.30 % of nitrogenous substances, 0.15 % of fat and 19.69 % of carbohydrates.

Nearly every year the nettle-tree gives an abundant crop of stone-fruit very rich in sugar (39.40 % when completely ripe), which makes a very useful foodstuff for live-stock, especially in districts where it is not possible to include sugar in the rations. The kernel contains 67.10 % of fat, that is to say, 7.02 % of that of the whole fruit. When ground the stones yield about 10 % of fat, but, if the kernels are separated from the woody part, this may amount to 60 %. In this case cakes containing about 12 % of protein, 12.4 % of fat and 48.5 of nitrogen-free extract, are obtained. The oil extracted may be used for various purposes.

The nettle-tree should be preferred to all other trees for replanting woods, and offers means of rapidly covering bare ground with plant growth. The speedy and large remuneration promised by its products may serve as an attraction to private land-owners who wish to help in the regeneration of Italian forests.

29 - *Pinus canariensis*, a Tree With Wood which does not Rot, Recommended for Replanting Forests in Warm Temperate Countries. — PEREZ, G. V., in *Bulletin de la Société Nationale d'Acclimatation de France*, Year 64, No. 8, pp. 322-325. Paris, August, 1917.

Pinus canariensis, a native of the Canary Islands, is a pine of warm temperate climates whose average annual growth exceeds 1 metre (3.28 ft.) in height and 1 cm. (0.39 ins.) in diameter. In 20 years it may attain a height of 20 to 30 metres and a diameter of 20 to 30 cm. (at Tenerife a specimen measures 50 metres in height and 2 metres in diameter). It is suited to all soils, from the sea coast to an altitude of 1 500 metres. Its trunk is straight, even when it grows in an isolated position, and its very thick bark prevents fire spreading from one tree to the other.

Its wood, known in the Canary Islands as "Tea" is very hard, very difficult to work, but unequalled for duration and building purposes because it does not rot. When buried it has the resistance of iron.

Pinus canariensis has a great future before it in warm temperate climates. For some years large plantations of it have been established in South Africa and have done exceedingly well. Excellent results have also been obtained in Chili. Even as the formerly sterile French Landes are now cultivated, thanks to plantations of maritime pines, so Egypt, Tripoli, Tunis, Algeria and Morocco could find a veritable source of wealth in *Pinus canariensis*.

1930 - **Nursery Practice in the National Forests of the United States.** -- TULLOCH, C. R., in *United States Department of Agriculture Bulletin No. 479, Contribution from Forest Service, Professional Paper*, 86 pp. 5 fig., XXII plates. Washington, 1917.

Each year about 10 million forest-tree seedlings or transplants are required for the reforestation operations in the National Forests of the United States. The paper analysed gives the rules to be followed in order to keep forest-tree nurseries in a good condition and to produce plants of suitable size and species, of superior quality and ready to be supplied when required. The writer first describes the factors influencing the selection of a nursery site, and passes on to the questions of the size and arrangement of nurseries — outfit — nursery operations — packing and shipping — diseases and injuries — use of fertilisers.

He finally deals with the cost operations and gives the following figures showing some of the actual costs of past nursery operations.

	Cost per thousand	
Growing 1 year stock	\$ 0.33	— \$ 1.50
Care of 2 year stock	0.06	— 0.40
Transplanting stock	0.77	— 2.01
Care of transplants first year	0.18	— 1.03
Digging, packing and shipping of stock	0.74	— 2.13

1931 - **The Utilisation of Ash in the United States.** -- STERRETT, W. D., in *United States Department of Agriculture, Bulletin No. 523, Contribution from the Forest Service, Professional Paper*, p. 51 + 5 figs. + X plates. Washington, D. C., June 29, 1917.

Ash is one of the leading commercial hardwoods of the United States. Its importance is due to the intrinsic qualities of the wood, for the quantity cut annually, which is from 200 to 300 million feet, amounts to from 25 to 3 per cent. of the hardwood lumber output, and to less than 1 per cent. of the total cut of all species.

The bulletin analysed deals with the use of the different species of American ash, and indicates the methods by which owners may utilise the ash timber profitably. It also gives an account of the properties of ash wood.

There are 18 species of ash native to the United States (1), but 1 per cent. of the ash lumber produced is from 3 species: white ash (*Fraxinus americana* L.), black ash (*F. nigra* Marsh), and green ash (*F. pennsylvanica* var. *lanceolata* Sarg.). The species making up the remaining 2 per cent. are Oregon ash (*F. oregona* Nutt.), blue ash (*F. quadrangulata* Mich.), Bill more ash (*F. biltmoreana* Beadl.), pumpkin ash (*F. profunda* Bush.), and red ash (*F. pennsylvanica* Marsh). All these species have good cultivation possibilities and are considered more important silviculturally than commercially.

Ash is the second most important wood used in aeroplanes. The greater bulk of the wood used for this purpose in the United States is spruce, but ash is especially suited for propeller blades, either alone, or in combination

(1) Cf. C. S. SARGENT, *Manual of the Trees of North America*, Cambridge, Mass., U.S.

with other woods (1). American ash has supplanted European ash (from the Baltic region) in English shipbuilding (rafters, oars, capstans, bars etc.). Export dealers pay from \$ 30 to \$ 40 per 1000 board ft.

Ash timber is extremely valuable for special uses and a number of articles (handles, butter tubs, vehicles and refrigerators) are made of it. As the supply of standing ash timber is becoming limited, the commercial growing of this tree is necessary to provide for future demands.

LIVE STOCK AND BREEDING.

932 - **Studies in Forage Poisoning.** — GRAHAM, R. and HEMMELBERGER, L. R., in *Journal of the American Veterinary Medical Association*, Vol LI, No. 2, pp. 164-187. Ithaca, N. Y., May 1917.

During the course of experimental studies in connection with a definite outbreak of forage poisoning, wherein an oat hay proved to be quite uniformly poisonous to horses and mules, various types of microorganisms were isolated from the forage. A spore forming, Gram negative, aerobic bacillus, designated in this paper as O-1 and O-2 culture, proved to be pathogenic when administered to horses and mules, less so for cattle, sheep and goats, while guinea pigs, rabbits and white mice were apparently immune. A bacillus possessing characters similar to O-1 designated in this paper as N-1 and N-2 culture, was isolated from a silage in a remote outbreak of forage poisoning among cattle.

It is contributive to the writers' knowledge of this outbreak that sterile filtrates of the bacillus described in this paper, subsequent to daily intravenous injection in some experimental horses, proved pathogenic and capable of exciting clinical manifestations somewhat analogous to those in animals originally affected as the result of feeding on the oat hay, i. e., increased respiration, partial paresis of the pharyngeal muscles and the muscles of the intestinal wall, incoordination, prostration and death. Some literature regarding the etiology of forage poisoning is quoted.

933 - **Sheep poisoned by Western Golden-Rod (*Solidago spectabilis*), in U. S. A.** — LOCKETT, S., in the *Journal of the American Veterinary Medical Association*, Vol. 51, No. 2, pp. 211-221. Ithaca, N. Y., May, 1917.

It would appear from this brief study that western golden-rod (*Solidago spectabilis*), a forage plant sometimes found in sheep-pastures in the west of the United States, possesses definite nerve-poisoning properties, both in its natural green condition and when cured in hay. The symptoms produced by this plant in sheep which have eaten it may be acute, sub-acute or chronic, according to the amount eaten. Five hundred grammes, eaten in 8 hours, produced, within 23 hours, a severe type of poisoning in a 6 to 7 months lamb. Suitable doses of chloral hydrate seem to be an efficacious antidote. Strychnine sulphate, although not tested by the Author, seems to be suitable for chronic cases.

(1) In Europe, ash wood is also much in request for the same purpose. (Ed.).

- 1034 - *Rhynchosia phaseoloides* and *R. minima*, Plants considered as Poisons to Live-Stock in the State of Rio de Janeiro, Brazil. — *Secretaria da Agricultura, Commercio y Obras Públicas do Estado de São Paulo, Boletim de Agricultura*, 18th. Ser. No. 6, pp. 451-453. São Paulo, June, 1917.

Communication by the "Director de Agricultura" of the State São-Paulo.

There are at least 10 species, with different varieties, of the genus *Rhynchosia* in Brazil, and some are considered poisonous to live-stock. This applies particularly to *R. phaseoloides* ("feijão bravo" or "olho de cabra") and *R. minima* ("feijãozinho bravo" or "olho de cabra mendo"). The former is common in the states of the Amazon, Bahia, Ceará, Rio de Janeiro, São Paulo, as well as outside Brazil, in Guiana, Colombia, Central America and the West Indies. The latter is found round the coast of Brazil and at Minas Geraes.

No analysis of these plants has been made.

- 1035 - **Enzootic Paraplegia in Lambs.** — TABUSO, M. E. (Istituto Nacional de Microbiologia Agrícola Sueros y Vacunas, Lima, Peru), in *La Clínica Veterinaria*, Year XXXI No. 16, pp. 457-472. Milan, August 31, 1917.

So far as is known at the present day, the disease known in Peru under the empiric name of *renguera* only affects sheep, and specially young ones. It occurs under the form of a mild paraplegia, with symmetrical, bilateral muscular atrophy, usually without loss of sensation.

The causes of the disease are completely unknown. Although it seems to be infectious or contagious (each year it spreads progressively in the districts near the original seats of infection), it is impossible to show the presence of any parasitic agent in the organs or organic products of the animal attacked. Attempts to transmit the disease experimentally have also been unsuccessful. Cold and damp have a favourable influence on the appearance and seriousness of the disease, and it is probably these factors which give it its essentially enzootic character and limit it to certain districts. Young animals certainly have a predisposition to it.

Facts collected up to the present point to the hypothesis that it is poisoning, of which the greatest effects are localised in certain zones of the neural axis.

Any mineral or alimentary action of the poison must be excluded, in sheepbreeding has been carried on for centuries in the districts now infected and *renguera* is a disease which, till a few years ago, was quite unknown. Until there are proofs to the contrary it seems best to assume the poison to be of a bacterial nature.

The disease cannot be cured therapeutically. Animals which are seriously attacked do not die if moved to dry surroundings and carefully fed; the disease then becomes chronic with a tendency to recovery. The flesh of animals slaughtered while sick is not harmful.

The only preventative measures possible are the isolation of infected flocks, the immediate slaughtering of the animals attacked, and the changing of pasture and the removal from low, damp districts to high, dry one

is also advisable to shelter the ewes and their lambs in huts during the night, so as to protect them from cold and damp.

Peruvian renguera (enzootic paraplegia of lambs) resembles infantile paralysis; it has also many points in common with *Argentine pataleta*.

36 - **Rinderpest in Swine: Experiments upon its Transmission from Cattle and Carabaos to Swine and Vice Versa.** — BOYNTON, WILLIAM HUTCHINS, in *Philippine Agricultural Review*, No. 9, p. 288. Manila, September 1916; reproduced in: *The Philippine Journal of Science*, Vol. XI, Sect. B., No. 5, pp. 215-265. Bibliographical index referring to 6 publications, 10 diagrams, 2 plates. Manila, September 1916.

Dr. STANTON YOUNGBERG, chief veterinarian of the Bureau of Agriculture of the Philippines, and other veterinarians on rinderpest quarantine work in the field have found that, in localities where rinderpest is present, pigs also develop an ailment practically simultaneously with the appearance of rinderpest in cattle and carabaos (zebus). In one case, in February 1908, in Romblon Island, it was found that an outbreak of rinderpest (a hitherto unknown disease there) among the cattle and carabaos was due to the importation of hogs from Capiz, some 120 kilometers south of the island, and here at the time rinderpest was prevalent.

There is but little literature upon rinderpest in swine, and this little is contradictory (CARRÉ and FRIMBAULT; FRIEDBERGER and FROHNER; UTYRA and MAREK; JOBLING).

The writer therefore tried to solve the question by means of experiment. He carried out the following experiments:

Healthy pigs were placed in stalls occupied by cattle suffering from rinderpest (experiments 1 to 10).

Healthy pigs were put into corrals occupied by pigs suffering from rinderpest (experiments 11-13).

Transmission of rinderpest from pig to pig by means of the caretaker (experiment 14).

Inoculation of healthy pigs with virulent blood from pigs suffering from rinderpest (experiments 15 and 16, in which 10 and 2 cc. of blood were used respectively).

Inoculation of healthy pigs with virulent blood from cattle attacked by rinderpest (experiments 17-20 with 6-20-8 cc.)

Inoculation of healthy pigs with virulent blood from cattle and pigs suffering from rinderpest (experiment 21).

Strong injection (50 cc.) of healthy pigs with virulent blood from a carabao suffering from rinderpest (experiment 22).

Healthy cattle were put into corrals occupied by pigs attacked by rinderpest (experiments 23-28).

Inoculation of cattle with blood from pigs suffering from rinderpest (experiments 29-32; amount of blood inoculated from 0.5 to 1000 cc.)

Inoculation of cattle with a mixture of blood from pigs and cattle suffering from rinderpest (experiment 33).

Inoculation of cattle with urine from pigs suffering from rinderpest (experiments 35 and 36).

Carabaos exposed to pigs suffering from rinderpest (experiment 36).

Inoculation of carabaos with blood of pigs suffering from rinderpest (experiment 37).

Inoculation of pigs with blood of carabaos suffering from rinderpest (experiments 38 and 39).

Transmission of rinderpest from cattle to pigs by means of the caretaker (experiment 40).

Test of immunity of pigs which had recovered from rinderpest (experiment 41, with 10 animals).

Recovery of pigs from rinderpest and their later infection with hog cholera (experiment 42, with 4 animals).

Hyperimmunity of pigs to hog cholera and their subsequent infection with rinderpest (experiments 43-48).

These results suggested to the writer the following conclusions:

- 1) Pigs can contract rinderpest when exposed to cattle suffering from that disease. The disease thus contracted may terminate in death, unthriftiness or complete recovery.
- 2) Pigs can contract rinderpest from: exposure to pigs suffering from that disease; to pigs or cattle contaminated by the caretaker; inoculation with the blood of pigs or cattle, or a mixture of the blood of pigs and cattle suffering from rinderpest; inoculation with the blood of carabaos suffering from rinderpest.
- 3) Cattle can contract rinderpest from: exposure to pigs infected with rinderpest (they, however, do not contract it very readily; the exact reason for this has not been ascertained); inoculation with the blood of infected pigs, or a mixture of the blood of infected cattle or pigs, or with the urine of infected pigs.
- 4) Carabaos can contract rinderpest from: exposure to pigs suffering from that disease; inoculation with the blood of infected pigs.
- 5) Pigs when once they have contracted rinderpest are immune for at least 665 days and no doubt for the rest of their lives.
- 6) Pigs which have recovered from rinderpest may die of hog cholera; this proves that the first disease does not render the animals immune to the second.
- 7) Pigs that have been hyperimmunised to hog cholera are susceptible to rinderpest when exposed to cattle suffering from rinderpest. Although the pigs used in the experiments (43 to 48) from which this conclusion was drawn did not suffer so severely from the disease as the average pig, there is a possibility that the strain of virus with which they were infected was one of the most virulent types. This condition is frequently noted in rinderpest in cattle: one strain may cause a high mortality, while another may cause a comparatively low mortality. Thus, it is rather difficult to state definitely that hyperimmunisation to hog cholera was of any benefit to the pigs when they were exposed to rinderpest.
- 8) In summing up the results of these experiments, it will be noted that cattle, carabaos and pigs vary but slightly in susceptibility to rinderpest and that the disease can be transmitted practically as readily from one kind of animal to the other, as among individuals of a single species.

77 - The Virulence of Hog-Cholera Blood at Different Periods During the Disease.

— WRIGHT, R. A., in *Journal of the American Veterinary Medical Association*, Vol. LI, No. 4, pp. 477-493. Ithaca, New York, July 1917.

In the production of hog-cholera blood for serum purposes the selection of the opportune time for killing the animals inoculated with virus is very important both from the technical and the economic standpoints. The writer carried out the experiments described in the paper analysed in order to determine the virulence of hog-cholera blood at different periods of the acute type of the disease. He found that there is a gradual increase in the virulence of the blood as the disease progresses from 4 to 8 days following inoculation, and that the 8 day blood was the most virulent.

Thus in producing the serum one may be justified in killing inoculated goats, beginning 6 days after inoculation, provided there is a corresponding high temperature and a manifestation of symptoms, especially weakness.

78 - Some Aspects of the Physiology of Mammary Secretion (1). — HILL, REuben

1. (Maryland Agr. Exp. Sta.), in *Journal of the American Veterinary Medical Association*, Vol. LI, No. 5, pp. 642-651. Ithaca, N. Y., August 1917.

The object of these investigations on goats was to continue the study of the effect of pituitary extract injection on the quality and quantity of milk secreted, its mode of action and the effect of its repeated injection upon the animal.

The conclusions reached were the following:

The injection of pituitary extract into lactating animals produces an immediate secretion of milk even though the mammary gland had been handled just preceding the injection.

The milk secreted as a result of pituitary injections has a super-normal content but the amount of milk and usually, but not invariably, the quantity it contains is decreased at the next milking period. The total daily secretion of milk is only slightly altered by the injection of pituitary extract; there may be either a slight gain or a loss in the total amount secreted.

The mammary gland of a goat does not respond to more than two injections of pituitrine given at two hour intervals.

If the injections of pituitary extract are continued for a sufficiently long period a temporary tolerance for its action on the mammary glands may be established. This tolerance may entirely disappear by the next lactation period. Similar results have been obtained by the injection of pituitary extract into lactating cats, dogs, goats, cows and the human subject, whereas as to the quantity and quality of the milk secreted and the rapidity of the response to the injection.

There seems to be good evidence in support of both the glandular and muscular theories of the action of pituitary extract on milk secretion. The results of these researches would, however, seem to lend themselves more to the support of the former theory.

¹ See also *R.*, August 1917, No. 75⁸.

- 1039 - **Utilisation of Farm Wastes in Feeding Live-Stock in the United States.**
 RAY S. H., in *United States Department of Agriculture, Farmers' Bulletin* No. 8
 Washington, D. C., August 1917.

The unprecedented demand for grain for human consumption makes imperative that only those feeds be used for live stock which are not used for human food.

More than one-third of the total production of grain straw in the United States is not being used to advantage and, of this amount, one-half is an absolute loss. Of the 245 million tons of corn stover produced annually in the United States it is estimated that only 81.5 % is fed to stock and that at least 35 % of this amount is lost through wasteful methods of feeding.

During the past years large quantities of cottonseed meal have been used for direct fertilizing, six of the Southeastern States having used in 1917 nearly 1 million tons for such purposes. This meal is worth from \$30 to \$40 a ton for feeding cattle, and about 25 % of its fertilizing value is lost when it is so used.

This bulletin indicates methods whereby these wastes may be eliminated, the herds and flocks economically maintained, and the amount of grain used for the feeding of live stock reduced to the minimum.

- 1040 - **The Use of the Leaves and Fruit of the Nettle-Tree for Feeding Live-Stock.**
 — See No. 1028 of this Review.

- 1041 - **Selecting Dairy Bulls by Performance.** — CARROLL, W. F., in *Utah Agricultural College, Experiment Station Bulletin* 153, pp. 1-20, Logan, Utah, April 1917.

Selecting dairy bulls by performance is fast coming to be recognized as the only reliable method. By performance in this sense is meant the ability of the bull to endow his daughters with powers of high milk production.

The data reported in this bulletin are taken from Volume 26 of the *Holstein-Friesian Year-Book* (U. S. A.), containing all entries to June 1915. Seventy-day records were considered because of an insufficient number of yearly records to be of value in a statistical study of this kind.

Only bulls having fifty or more daughters registered in the official "Advanced Register" are considered. The list contains 32 bulls, including most of the very famous Holstein bulls. These 32 bulls have to their credit a total of 2 579 tested daughters and 1 052 proven sons, who in turn have 7 632 tested daughters. The calculations include, therefore, 2579 records in one group and 7632 in another, or a total of 10 211 individual butter-fat records.

The study is, therefore, of necessity of a selected population. Untested daughters are manifestly not included and only the tested daughters are considered that have produced at least the minimum butter-fat requirements set by the association, other records not being entered in the Advanced Registry Books.

The following tabulation of these 10 211 records classified according

age of cow indicates that the present association age requirements do really represent the average productive capacities of cows of the respective ages.

*Average Fat Produced and Average Percentage Value
of 10 211 Cows by Ages.*

Age	Years	Daughters of 32 bulls			Sons of 32 bulls			Total			Standards	
		No. of cows	Average lbs. fat	Percentage Value	No. of cows	Average lbs. fat	Percentage Value	No. of cows	Average lbs. fat	Percentage Value	Present	Revised
jun.	2	490	11.7	162.5	2 266	11.4	158.3	2 756	11.5	159.7	7.2	7.7
jun.	2	257	13.0	162.5	954	12.7	158.7	1 211	12.8	160.0	8.0	8.6
jun.	3	247	14.6	165.9	962	14.5	164.8	1 204	14.5	164.8	8.8	9.8
jun.	3	251	16.1	167.7	786	15.2	158.3	1 037	15.5	161.5	9.6	10.4
jun.	4	253	17.0	163.5	652	16.5	158.7	905	16.6	159.6	10.4	11.2
jun.	4	209	18.1	161.6	493	16.6	148.2	702	17.0	151.8	11.2	11.5
sl.	—	877	18.4	153.3	1 519	17.5	145.8	2 396	17.8	148.3	12.0	12.0

If the age requirements of the Association were in accordance with the relative productive capacity of each class, the average percentage values all would be approximately the same. As it is, however, the cows of the group (aged) produced on the average only 48.3 % more than the Association requirement for that age, while the cows of another group (Junior three year old) exceeded the requirement by 64.8 %. It is easier for a junior three-year-old cows to attain to the Advanced Register than it is for the others. The senior three-year-olds stand next, while the aged cows stand last.

The last two columns in Table I show clearly the differences between the present association age requirements and the actual average productive capacities of cows of the different ages as shown by the 10 211 records included in this study.

Treatment of the Data. Under each bull's name were listed the records, placed on a percentage basis, of all of his daughters. For example, a junior two-year-old daughter of a certain bull has a seven-day record of 118 pounds of fat. This is 150 % of the Association requirements for a junior in this class (7.2). The value of her record was therefore listed as 30 %. This process was continued for the record of each daughter. Conversion to these percentage values eliminated age, thus placing all records on a comparable basis. The averages of these values for the daughters of each bull can be considered the comparative values of the bulls, as related by the performance of their A. R. O. daughters.

From the tables presented it appears that the number of A. R. O. daughters a bull has cannot be taken as a true index of his value as a breeder — this may indicate only his opportunity. Neither can his real

value be measured by a few high — producing daughters. High average production in all of his daughters is the final measure of a good bull.

The list of the thirty-two bulls arranged in descending order in the average percentage value of their daughters is headed by King of the Pontiacs 702-39 037 (149-76-30) a ten-year-old bull having 149 A. R. O. daughters with an average percentage value of 186.4. King Segis stands second with a value of 181.2. Lord Netherland De Kol has been heralded as some as the great bull of the breed, because until 1915 he had the greatest number of A. R. O. daughters. He was surpassed in this regard in 1916 by King of the Pontiacs. When judged by the performance of all his A. R. O. daughters, Lord Netherland De Kol stands lowest in this list of thirty-two bulls with an average of 133.9. The tabulations also show that the coefficient of correlation of the average value of the daughters of the thirty-two bulls examined and the value of the daughters of the sons of the same bulls is higher than might be expected (0.6326 ± 0.0715). This, however, is not considered evidence that milk production is transmitted through the male line. The writer regards it merely as greater intensity of breeding on the part of the bulls, due to the more rigid selection for milk production which they have undergone.

1042 — Stock-Breeding in Switzerland during the War. — KÄPPELI, DR., in *Annuaire agricole de la Suisse*, Year XVIII, Pt. 1, pp. 15-26. Berne, 1917.

The last livestock census taken in Switzerland, on the 19th. Apr. 1916, gave the following results.

	1916	Increase (+) or decrease (—) on the 1911 census
Cattle, total	1 615 645	+ 172 102
Cows	848 652	+ 51 713
Horses, total	136 613	+ 7 515
Brood-mares	10 055	+ 3 631
Pigs, total	544 021	+ 26 205
Sows	54 424	+ 1 451
Goats	358 093	+ 16 707
Sheep	171 635	+ 10 221

The increase in cattle is very marked. Already before the war, when the price of milk was falling, the breeding of young cattle had increased. As a precautionary measure, the Federal Council, by the decree of the 8th August, 1914, forbade the slaughtering of calves under 6 weeks old. The aim of this measure was to prevent a depreciation in the value of fat calves and milk, and to encourage the breeding of young cattle. Later, the regulations concerning the slaughtering of calves were modified, then, last autumn, suspended, in order to increase the quantity of milk available for human consumption.

The increase in horse-breeding is comprehensible in view of the fact that, since the 1st. August, 1914, importation has practically ceased. An attempt should be made to produce a medium weight draught-horse, strong legged and speedy; these qualities are all found in the improved Franche Montagnes horse.

Poultry rearing is fighting against great difficulties. Not only is the grain required for feeding the poultry very dear, but it is also very scarce. By a decree of the 30th. January, 1917, the Federal Council authorised the export of native grain to poultry.

The organisation created for the exportation of cattle will play a great part, after the war, and will continue to be of great value to Swiss stock-breeding. There is also no doubt that the milk producers' societies and organisations will henceforth have a great influence on the dairy industry, to the advantage not only of the producers, but also of the population and country.

Silage for Beef Production. — STARR, CH. G. (Purdue University), in *The Breeder's Gazette*, Vol. LXXII, No. 11, p. 374. Chicago, September 13, 1917.

The problem of reducing the cost of feeding either by using cheap feeds, or securing more feed per acre, or both, must be faced to day by cattlemen in order to remain in the cattle feeding business. In fact, with prices at \$1.25, \$1.50 and \$1.75 per bushel many cattlemen have given up business.

Until the advent of the silo the best dry-lot ration was probably the one made of maize, cottonseed meal and clover hay.

For eight years maize silage has been introduced into the clover hay ration by the Indiana Experiment Station at Purdue University.

The following table gives the average feed required to produce a pound of beef, showing the value of silage as roughage with clover hay during the winters from 1909 to 1917 with 160 cattle.

Feed	Feed per pound of gain	
	Lots without silage	Lots with silage
Maize.	7.30 pounds	5.57 pounds
Cottonseed meal	1.18 "	1.19 "
Clover hay.	4.93 "	1.34 "
Maize silage	— "	11.65 "
Daily gain.	2.42 "	2.58 "

The average prices received for the clover hay lots and the silage lots have been approximately the same, varying slightly from year to year. For every 100 pounds of beef put on by the steers 1165 pounds of corn silage replaced 146 pounds of shelled corn and 359 pounds of clover hay. Taking the price of clover hay at \$15 per ton, the following table has been compiled from the replacement of corn and hay by silage to show the worth of corn silage in fattening cattle when corn varies in price:

When maize is worth	A ton of silage is worth
50 cents per bushel	\$ 7.12 per ton
60 cents per bushel	\$ 8.64 per ton
\$ 1.00 per bushel	9.22 per ton
\$ 1.25 per bushel	10.21 per ton
\$ 1.50 per bushel	11.30 per ton
\$ 1.75 per bushel	12.50 per ton

To answer the question as to whether all the clover hay could be replaced by corn silage, 80 cattle were fed, from 1909 to 1913, with the following ration :

Feed	Feed per pound of gain	
	Silage alone	Silage and clover hay
Maize	5.97 pounds	5.67 pounds
Cottonseed meal	1.14 "	1.12 "
Silage	12.65 "	11.16 "
Clover hay	—	1.14 "
Daily gain	2.37 "	2.45 "

About a third of a lb. more of shelled corn was needed by the silage alone cattle for each lb. of gain in addition to the extra silage consumed. The gains were in favour of the lots receiving clover hay in addition to silage.

To settle the question as to whether some cheap roughage such as oat straw could be substituted for the clover hay a series of lots from 1911 to 1914 was fed on oat straw instead of clover hay. The following table shows the results with 60 cattle :

Feed	Feed per pound of gain.	
	Oat straw lots	Clover hay lots
Maize	5.60 pounds	5.66 pounds
Cottonseed meal	1.14 "	1.15 "
Straw or hay	0.50 "	1.08 "
Silage	10.58 "	10.37 "
Average daily gain	2.45 "	2.40 "

It appears that oat straw is as good as clover hay in giving fattening cattle a little dry filler in a ration of shelled maize, cottonseed meal and maize silage. The cattle eating rations containing liberal amounts of maize silage will only consume a small quantity of dry roughage. Oat straw seems to satisfy them. The finish carried by the cattle in these lots was practically the same.

When it is considered that a 50 bushel crop of corn will produce 1 tons of silage in the silo, the cattle feeder may materially reduce the cost of his feed till over that of even such a good ration as maize, cottonseed meal and clover hay and at the same time he will produce more available cattle feed per acre of his farm. The cattleman using silage can eliminate his non-silage neighbour through economy of production, as he is feeding at less cost.

1044—The Improvement of "Caracá" Cattle in the State of Sao-Paulo, Brazil. — DE CAMPOS PENTEADO MARCILLO, in *O Criador Paulista*, Year XII, No. 7, pp. 253-7 + 22 figs. Sao-Paulo, July, 1917.

A breed may be improved by two methods — crossing and selection. In Brazil, where the "Caracá" breed is concerned, there are many obstacles

(1) See: *R.* 1911, No. 1825; *R.* 1912, No. 1438; *R.* 1916, Nos. 1093 and 1195.

(Ed.)

to the first method: 1) lack of resistance of European improving stock to piroplasmiasis or "tristeza"; 2) the danger of introducing tuberculosis into Brazil with European animals; 3) lack of adaptation of the European breeds to the environment (climate and pasture) of Brazil. This explains the many disasters with which the introduction of foreign bulls, begun in the State of São-Paulo in 1897, has met. Since that date, up to 1916, out of 979 improving bulls imported from the Argentine, Uruguay and Europe for the "Posto Zootecnico Central Dr. Carlos Botelho" and other institutes, 543, or 55 %, died of piroplasmiasis. This percentage is believed to be still higher for stock imported for private breeders. As the cross-breeds gave the same characters as the improving breed, they must have the same food as the latter have in their native land; but the Brazilian pasture-lands are composed essentially of Gramineae and rarely contain Leguminosae, while lucerne fields do not exist in the country. On the other hand, crossing, repeated periodically, by which this difficulty might be overcome, is not in the power of the ordinary breeder, who has not sufficient knowledge to apply this method scientifically. Crossing, therefore, is only to be recommended in exceptional cases, for dairy or beef stock, but never for breeding stock.

The best breed for selection in the State of São-Paulo is the "Caracú" breed. This is proved conclusively by the excellent results obtained with it at the "Posto Zootecnico" of Nova Odessa.

Table I compares the coefficients of growth (1) given by MR. VILLEKESME (*L'élevage en Europe et en Amérique*) with those obtained by the above-mentioned Institute for the "Caracú" breed. It will be seen that the "Caracú" breed surpasses the early maturing breeds in this respect.

TABLE I. — *Coefficients of growth of the "Caracú" breed compared with those of early maturing breeds.*

Early maturing Cattle			"Caracú"		
Age	Live weight	Coefficient of growth	Age	Live weight	Coefficient of growth
1 year	300 kg.	22.5	1 year	298.8 kg.	22.4
2 years	480	18.7	2 years	521	20.4
42 months	650	14.7	36 months	745	19.8

Of the cows, only certain cross-breeds of the 1st. generation with the best breeds (Dutch, Schwytz, Simmenthal, Red Polled, Devon, Hereford) are a greater coefficient of growth than the Nova Odessa "Caracú" cows. This shows that, by improving the breeding methods, the selection of a superior breed would proceed with great rapidity.

The "Caracú" breed may be selected for beef as well as for milk and draught.

(1) The coefficient of growth (or development) is determined by dividing the weight of the animal minus its average weight at birth (30 kg.) by the number of months of its life.
(Ed.).

With regard to beef cattle, animals bred in the open frequently attain 1760 lbs. of live weight. At the São-Paulo exhibition of May 1917, there was an animal which, without having been subjected to any special intensive feeding, weighed 2090 lbs. The frame is fairly small. Table II gives the results of experiments on the yield at slaughtering made in May, 1917, at the Osasco frozen-meat lairage of the Continental Product Company, with ordinary "Caracú" cattle bought on the market.

TABLE II. — Yield of "Caracú" cattle at slaughtering.

	3 young oxen	3 adult oxen
Live weight	3 355 lbs.	5 302 lbs.
Net weight of meat	1 881	3 196.6
Percentage of meat	56.06 %	60.29 %
Weight of the fresh skin	275 lbs. = 8 %	412.4 lbs. = 8 %

Under ordinary conditions of breeding, the lactation period of the "Caracú" cow is very short, but the Nova Odessa results prove that it is sufficient to pay careful attention to its food and, above all, to milk it regularly, in order to turn it into a good dairy cow. Five cows, during the first period of lactation, which lasted 12, 10, 10, 11 and 10 months respectively, gave 5 669.62, 3 584.46, 3 016.86, 2 893.44 and 2 864.18 lb. of milk. This milk has a high fat content, 1.6 to 1.7 galls. being required to obtain 1 lb. of butter.

The improved European cows which were imported into Brazil suffered a great reduction in the percentage of calves produced. The report presented in 1915 to the Minister of Agriculture of the State of São-Paulo by the Inspector of zootechny who investigated the results of the introduction of foreign cattle into the state includes the following calving percentages for "Caracú" × European dairy breed cross-breeds; the figures were collected from 18 farms: Dutch cross-breeds, 65-70 %; Schwytz cross-breeds, 70-73 %; Simmenthal cross-breeds, 50-60 %; Red Polled cross-breeds, 78-80 %; Devon cross-breeds, 70-74 %; Hereford cross-breeds, 75-80 %. These averages are greatly exceeded by those obtained at Odessa for the pure "Caracú" breed, which are 89 to 95 %. The cows are usually put to the bull at 21 months, but some are quite ready at 11 months. The bulls are used for service when from 16 to 18 months old; some could be used at 11 months.

In order to encourage the improvement of the race, a "Caracú Herd Book" has been started in the State of São-Paulo; in July, 1917, 10 cows and 78 bulls were entered in it. It is composed of two herd-books, one temporary, the other permanent. In the first are entered breeding stock and their offspring approved and marked by an official Commission; these when adult, are subjected to a closer examination and, if approved, are entered in the permanent herd-book.

The paper contains about twenty portraits of fine specimens of the "Caracú" breed, of which the bull "Mozart" is a particularly excellent example.

45 - *The Outlook for Farm Sheep Raising in the United States.* — MARSHALL, F. R. and MILLON, R. B., in *Farmers' Bulletin* No. 840 of the *United States Department of Agriculture*, pp. 1-24. Washington D. C., July 1917.

An important change in the extent and character of the American farm sheep industry began in 1915. Higher prices for lambs and wool in that year and the years following attracted wide attention to this branch of animal husbandry.

The higher prices of sheep products after 1914 were caused in part, but not mainly, by market conditions resulting from the war. The supply of lamb and mutton had been decreasing for some time in spite of the growing demand, particularly for lambs. Wool values were advancing before the outbreak of the war. Although the world consumption of wool was increasing, no foreign country, with the exception of South Africa, seemed able to increase its exports. Increased supplies of wool in the future must come chiefly from farm flocks.

In the United States, conditions for farm sheep raising are more favourable than in any country which has not already developed to the extent at which sheep are necessary for intensive farming.

Sectional Prospects for Sheep production. -- In the Eastern States the large and numerous flocks of earlier years were kept almost entirely for wool production. Subsequently the increasing wool supplies from other sections and from abroad, together with the demand for other agricultural products of higher value, brought about a decline in the number of farm sheep in these States. The cheaply produced western supplies were for some time equal to all requirements. To day the western shipments have not only ceased to increase, but have actually grown less as a result of the reduction of the range area.

In New England the sheep raising of the present is planned to market lambs at from 4 to 5 months of age, and wool, though important, is not the primary consideration. The full and economical utilization of New England farm labour, pastures, hay and silage calls for more and larger flocks to supply the near-by markets. The present production can probably be multiplied three times without materially lessening other live-stock production.

Throughout the entire length of the Appalachian Mountain Range in Pennsylvania, Maryland, Virginia, West Virginia, Kentucky, Tennessee and North Carolina, there are large areas of land of comparatively low value and well suited for sheep raising.

In the hilly sections of northern Arkansas and southern Missouri and in the cut-over timber region of the Gulf States there are also large areas of comparatively cheap lands which furnish favourable conditions for the rearing of large flocks of sheep at comparatively low cost. Similar opportunities are found in the cut-over timber lands in Michigan, Wisconsin, Washington and Oregon.

On the higher priced lands of the corn belt a profitable system of sheep raising is being worked out along the lines followed on the intensively farmed areas in England and Scotland. While land values in this section

are much higher on the acre basis than in the regions referred to above there is comparatively little difference in the value of the amount of land required per head for sheep. While few farms in this section are likely to be devoted exclusively to commercial sheep raising, the different labour requirements for cattle and swine make it possible to keep at least 1 ewe to 2 acres. This should add materially to the net income from the farm.

On western irrigated farms there seems likely to be developed an intensive sheep industry. The alfalfa and other forages produced on these lands come nearer to being satisfactory as a sole ration for sheep than for any other stock. The use of irrigated pastures based on the rotation of forages will provide excellent summer feed and at the same time avoid the cost of labour for harvesting where there is not an opportunity of using the open range or forest reserve for grazing at that time of year.

This bulletin contains important suggestions for beginners in farm sheep raising and management.

1046 - **The Model Garbage-Disposal Piggery belonging to Worcester, Massachusetts**
U. S. A. - BONNET, FREDERIC, JR., in *Engineering News-Record*, Vol. 79, No. 5
pp. 306-308, 8 figs. New-York, August, 30, 1917.

Worcester is a town of about 175 000 inhabitants in which about 70% of the garbage is fed to pigs.

The town has a home farm of 376 acres and, in addition, leases another of 220 acres. On these farms are kept 2 000 to 3 000 pigs. Pig-breeding as a means of utilising the town refuse has been carried out since 1872.

To facilitate the collection of the garbage the town is divided into 27 sections. There is a special collection for the fish offal and rotten eggs from markets and commission houses. This material, which is not fed to the pigs, is buried.

Each collector collects one load, which he deposits at the farm. He also has to unload and clean his wagon and attend to his horses. There is however, a special employee for feeding the horses. The teams leave the farm at 7 a. m. and have an average daily haul of 13 miles. It takes from 2 to 4 hours to collect a load, the average time per house collection being 1.65 minutes. The Board of Health requires that the garbage be placed in water tight, covered receptacles, and that no tin cans, water, ashes, glass shells, etc. be placed in the receptacles. An average of 20 tons of refuse is collected per day. The use of municipal garbage has never caused any disease amongst the pigs, and garbage-fed hogs command the same price as hogs fed by the ordinary methods.

The pigs eat the garbage as it is brought to the farm; it is neither washed nor steamed. Young pigs are kept with the sow till they are 6 weeks old and are kept in pens till they are 6 months old, when they weigh about 7 to 100 lbs. They are then turned into hog-lots (100 pigs to about 3 acres). The refuse is fed to the pigs on feeding platforms. When the soil around the platforms becomes fouled, the platforms are moved and the ground ploughed up. This system prevents the formation of any bad smells. It

platforms are cleaned every day, and the material removed composted or burned.

When 5 to 6 weeks old the pigs are inoculated (double-treatment method, virus and serum) against cholera. The total cost of treatment, a 20 cc. injection, which has proved very efficacious, is 70 cents. per pig exclusive of the necessary help. In 1915 the herd was attacked by an epidemic of foot-and-mouth disease; 2 360 animals were killed, the cost being borne partly by the Federal Government and partly by the State. The sows are bred by turning about 300 of them into the same lot with about 30 boars for about 3 weeks. The first lot are bred from about October 20th. till December 1st. farrowing thus begins at the end of January and continues till early March. After a month or six weeks a second lot of sows are bred, and so on. The pigs are kept for about 15 months, when they weigh 250 to 300 lbs. The last lot sold (May, 1917) realised 16.35 cents. per lb. live weight, or 11 cents per lb. dressed weight.

The herd is kept in 12 pig-sties scattered about the farm. Details of the piggeries, of which the most recent cost \$ 3 000 each, are given. In addition, there are 100 small portable take-down pens for late spring farrowing.

Details are also given of the cost of garbage collection and of the upkeep of the pigs, which at present amounts to about \$ 60 000. The expenditure generally exceeds the receipts, but, nevertheless, feeding garbage to hogs is considered the most economical and satisfactory method of disposal, and it has been proved that, if it be done in a sanitary and intelligent manner, there is an absence of any appreciable smell.

347 - **Protein Feeds for Laying Hens** (1). KEMPSTER, H. L., in *University of Missouri College of Agriculture, Agricultural Experiment Station Circular* 82, pp. 1-12. Columbia, Missouri, June 1917.

Tests to determine the value of beef scrap and sour milk. Feeding tests conducted at the Missouri Agricultural Experiment Station have shown that sour milk or beef scrap added to the poultry ration materially increases egg production. These tests extended from November 1, 1914 to October 31, 1915 and from November 1, 1915 to October 31, 1916. Results of these tests together with results from feeding protein concentrates of vegetable origin are presented in this bulletin.

From the tests it appears that the addition of protein concentrates of vegetable origin, such as oil meal, glutenmeal and cottonseed meal, to a ration has but little influence on egg production. Where sour milk, or beef scrap was used the production was very nearly double and while the cost of the ration was increased from 9 to 13 cents per hen per year the extra profit paid for this ten fold. The oil meal mash was not consumed in as large quantities as the other mashes, indicating that the hens did not relish this as much as they did the other mashes.

(1) See also R. Sept. 1917, No. 837.

The following table shows how protein feeds affected egg production

Basal ration of grain and mash plus various proteins.

Protein feeds	Eggs produced
Sour Milk	129 per hen per year
Beef Scrap	120 per hen per year
Cottonseed Meal	66 per hen per year
Linseed Oil Meal	64 per hen per year
Gluten Meal	63 per hen per year
No Protein Feed	57 per hen per year

In each case the protein feed constituted approximately one-twelfth the mash (bran 1, corn meal 1, shorts 1) three-twelfths, and the grain (corn 2, wheat 1) eight-twelfths, of the ration by weight.

With the cost of feed based on the quotations of a local mill at the following rates: wheat at \$1.66 per 100 pounds; corn at \$1.60 per 100 pounds; bran at \$1.20 per 100 pounds; corn meal at \$1.70 per 100 pounds; shorts at \$1.40 per 100 pounds; beef scrap at \$3.25 per 100 pounds; sour milk \$0.2 per 100 pounds; the average cost of food per hen per year was \$1.62 for the beef scrap ration; \$1.05 - 1.14 for the sour milk ration; and \$0.956 - 1.00 for the ration without beef scrap or sour milk. The average per hen per year of beef scrap supplied was 4.2 - 5 pounds; and of sour milk 88-83.8 pounds. The total food cost of a dozen eggs produced was \$0.12 for the beef scrap ration; \$0.10 - 0.112 for the sour milk ration; and \$0.222-0.21 for the ration without meat or milk, on account of the different amount of eggs obtained with the different rations.

1048 - **The Feed Cost of Egg Production; Experiments in U. S. A.** — LAMON, H. M., and LEE, A. R., in *United States Department of Agriculture, Bulletin No. 561*, pp. 42-54, Washington, D. C., August 18, 1917.

Results of 3 years' experiments at the Government Poultry Farm. During the third year, sixteen pens, containing 366 fowls, were used for the experiment.

The average egg yield for the first laying year in all pens was 104 eggs and the highest pen average yield was 169.5 eggs. In the second year the average egg yield of all pens was 92.7 eggs, which decreased to 77 eggs in the third laying year.

Eggs were produced at an average cost for feed only of 10 cents a dozen during the pullet year, of 14 cents in the second year, and 19 cents in the third year. Prices of individual grains in 1917 are from 20 to 100 per cent. higher, which should be carefully considered in estimating the present cost of egg production.

The average value of eggs over feed cost the first laying year was \$2.25 per hen, falling to \$1.41 the second year, and to \$0.79 the third year. The highest average value in any pen was \$3.41.

The general-purpose fowls consumed annually 72 pounds of feed which cost \$1.13, while the Leghorns ate 55 pounds, which cost 87 cents.

Good results were obtained with rations both with and without oats. The use of this grain in the variety to the ration without increasing the cost. Fowls not fed any beef-scrap or other animal protein laid only 90 eggs during their pullet year compared with 137 eggs from the beef-scrap pens, and 4 compared with 83 in their second year. The eggs of the no-beef-scrap pens cost about 2.2 cents per dozen more to produce the first laying year, but these costs were about equal during the second year. The fowls not fed beef-scrap laid very poorly in winter, thus materially reducing the value of their eggs.

Cottonseed meal used in place of beef scrap as a high-protein feed in the ration produced brown or greenish spots on the yolks of the eggs, especially in warm weather, making a considerable proportion of them unfit for market. Eggs were produced more cheaply and at a considerably greater profit on the beef-scrap ration.

Fish meal at \$ 7 a ton less than beef-scrap proved to be a good high-protein feed, which can be used to advantage to replace beef-scrap. The fish meal did not in any way affect the flavour or quality of the eggs.

General-purpose fowls allowed to select their own mash constituents ate a dry mash containing about 63 per cent. cornmeal, 19 per cent. beef scrap, 9 per cent. bran, and 9 per cent. middlings. Leghorns ate a mash about 66 per cent. cornmeal, 26 per cent. beef-scrap, and 4 per cent. each of bran and middlings. No better results were obtained by this method of feeding than where the ground grains were mixed together in a mash.

Good mashes, as indicated by these experiments, may be made of 66 per cent. cornmeal, 26 per cent. beef-scrap, and 4 per cent. each of bran and middlings, or 2 pounds of cornmeal and 1 pound each of bran, middlings, and beef-scrap, with a scratch feed in each ration of equal parts by weight of cracked corn, wheat, and oats, which is fed so that the hens receive about equal parts of scratch feed and of mash.

The Leghorns on free range gave a considerably greater egg yield than those confined to a fair-sized yard. This difference was less marked in the general-purpose hens.

Sprouted oats fed as green feed to hens confined to yards cost about 10 cents per hen a year and 1 cent per dozen eggs, not including any charges for labour and equipment. The hens ate on an average in one year about 3 pounds of oyster shell and 0.7 of a pound of grit, which together cost about 1 cent per hen.

The Leghorns did not lay as well in the winter as the general-purpose breeds, especially during their second year, but the Leghorns produce eggs about 3 cents per dozen cheaper during their first year, 6.4 cents cheaper in their second year, and 9.8 cents cheaper in their third year than the general-purpose breeds. One pen of Leghorn pullets produced eggs in their first year at a feed cost of 6.7 cents per dozen, while the value of the eggs for hen for the year was \$ 3.41 over cost of feed.

The average weight of a dozen eggs from the general-purpose fowls during their pullet year was 1.53 pounds, 1.60 during their second year, and 1.63 during their third laying year. The eggs from the Leghorns aver-

age 1.45 pounds during their pullet year, and 4.19 during their second and third years.

The egg production of the general-purpose fowls decreased 32 per cent in their second laying year. The decrease was considerably less in the Leghorns, their 2-year average egg production exceeding that of the general-purpose breeds by 19 eggs. The decrease in production from the second to the third year was only 4 per cent. with the Leghorns, compared with 10 per cent. in the general-purpose breeds.

The cheapest eggs are produced in the spring, during April, May and June, while the greatest costs occur in October, November, and December. The lowest monthly feed cost of a dozen eggs in any of these experiments was 4 cents, while in some cases no eggs at all were produced during 1 month.

1049 - **Turkey Raising in Texas, U. S. A.** — See No. 1081 of this Review.

1050 - **The Biology of the Larvae and Moths of *Bombyx mori* of Parthenogenetic Origin.** — LUCMILLON, A., in *Comptes Rendus de l'Académie des Sciences*, Vol. 165, No. 289-291, Paris, August 20, 1917.

In a recent paper (1) the Author reported that he had successfully obtained and reared 4 larvae from eggs laid by a female of *Bombyx mori* which had been prevented from mating. The results of his observations on breeding out these larvae, their sex, reproduction and progeny were as follows:

1) The 4 larvae fed easily on leaves of white, black or red mulberry. Their growth was rather slower (an average of 45 days) than that of normal larvae. When they spun their cocoons, 3 of the larvae were of the same size as normal larvae, the 4th. was much smaller (only 2 grammes).

2) The duration of the pupal stage was also a little longer than normal (16 to 17 days).

3) Of the 4 moths, 3 were males and 1 female. One of the males was extremely small and could not mate; the other 3 moths showed no outward difference from those of normal origin, and mated in the usual way.

4) The breeding of the two males and the female was studied as follows:

When the first male was put with an ordinary female, copulation immediately took place and was of normal duration. The fertilised female laid about 300 eggs of which one only remained pale yellow, i. e., escaped fertilisation, whereas the others underwent normal change of colour. After the first oviposition, copulation again took place, followed by a second oviposition of 56 eggs, of which only 4 were unfertilised.

The second male behaved in a similar way to the first. The female with which it was mated laid about 250 eggs, of which 10 were unfertilised.

The female of parthenogenetic origin when isolated laid first 45 eggs then 63 more. Mated with an ordinary male it laid 195 more eggs. On

(1) See *R.*, October 1917, No. 936.

ne of the eggs laid before mating underwent change of colour. The eggs laid after mating, with the exception of 6, changed colour normally.

Conclusions. — The two sexes are present among larvae of *Bombyx mori* produced by parthenogenesis. The evolution of the larvae, chrysalides and moths of parthenogenetic origin differs but little from that of individuals of normal origin. Well-constituted individuals of parthenogenetic origin breed in exactly the same manner as normal individuals. The capacity for parthenogenetic reproduction does not appear to be more marked in females of parthenogenetic origin than in those from fertilised eggs.

FARM ENGINEERING.

51. **Trials of Agricultural Tractors at Noisy-le-Grand, France, in 1917.** — RINGELMANN, MAX, in *Feuille d'Informations du Ministère de l'Agriculture*, Vol. 25, No. 31, pp. 80. Paris, July 31, 1917.

Twenty-seven machines took part in the trials at Noisy-le-Grand, 7 being of French, 1 of Italian, and 15 of American construction.

The published report only deals with 9 tractors; the writer will shortly publish the results of the trials of the other machines.

The appended table (see page 1124) gives the results, showing for each tractor the fuel used (1), the stated H. P., and the sale price without the engine.

52. **The Annual Work of a Tractor in France.** — RINGELMANN, MAX, in *Bulletin de la Société Française pour l'Industrie Nationale*, Vol. 128, No. 3, pp. 120-129. Paris, July-August, 1917.

Information supplied by M. COULHER to the writer regarding the use of a 20 H. P. EMERSON tractor, owned by the "Syndicat de culture mécanique" of Etampes, Seine-et-Oise, France. The machine, with accessories, cost about £ 555.

From May 1 to December 31, 1916, the tractor was used on 115 days, representing 909 actual hours of work : 449.73 acres were ploughed.

For 1917, the tractor was expected to be used on 170 days, or 1360 working-hours, for ploughing from 662.35 to 667.19 acres at 6 inches depth, which appears to be the maximum. In 1916, the average working day was of 8 hours, during which 3.9 acres were ploughed to a depth of 6 inches ; the soil was a sandy clay often difficult to work in hot weather. The wages of the 2 drivers, driving the tractor in turn, was 3s. 2d a day each, plus a bonus of 7.7 d. for each acre ploughed 6 ins. deep. These wages are paid by the employers, who paid about £ 24; the Society paid, for its part, about £ 3 for time in moving from one place to another, stoppages, etc. The total wages paid amount to an average of 3s. 9.4 d. per day for the 245 days, or 75.11.86 d. per working day of the 115 actually worked.

(1) The paraffin used in the trials had a density of 0.77 at 15°C; 1 gallon weighed 7.3 lb. In the trials the fuel is given by weight.

Results of ploughing trials.

Machines	Fuel	H. P.	Sale price without plough	No. of order	Depth	Labour	Average speed of plough per hour	Average time for turning	Time to plough 1 hectare (h)	Surface required per hour	Consumption of fuel	Tractive effort		Average speed of plough		Draw-bar pull	
												average total	average per sq. dm.	kg.	m. per hour	Kilogram.	H. P.
			francs		cm.	metr.	metres	seconds	minutes	sq. metres	kg.	kg.	kg.	kg.	m. per hour		
A) Mogul	Paraffin	16	9 300	1	12.0	0.01	10.60	30	5h 1 m	1 902	4.19	21.6	541.8	49.8	0.85	462.23	6.16
					16.7	1.00	2 880	30	4h 49m	2 076	5.72	27.3	835.0	50.0	0.86	668.00	8.90
				3	13.8	0.93	2 880	32	5h 4 m	1 974	5.85	29.5	599.1	46.7	0.83	497.25	6.55
													Plough 599.1	46.7			
													Harrow 266.2	46.1			
B) Titan		20	11 000	4 (*)	13.0	0.90	2 916	41	5h 33m	1 228	10.76	59.7	Total 799.5	0.81		647.59	8.65
					17.8	1.00	2 844	32	4h 54m	2 040	7.37	36.1	854.4	48.0	0.79	674.97	8.90
					12.8	0.96	3 672	31	4h 46m	2 100	7.38	35.1	565.5	46.3	1.02	578.57	7.75
C) Ford and Son.		20	—	7	16.2	0.78	2 042	30	4h 21m	1 200	5.80	33.4	618.8	49.0	0.97	552.71	4.70
					13.0	0.71	5 472	30	4h 1 m	2 490	7.86	31.5	533.4	57.8	1.52	810.76	9.47
D) Big Four D.		35	—	9	16.5	1.37	2 618	30	3h 50m	2 610	5.30	24.1	1 030.6	46.0	0.73	758.90	10.11
					13.0	1.37	3 096	30	3h 18m	3 090	7.62	25.1	837.0	47.0	0.86	719.81	9.59
E) Eastman		20	15 000	12	14.3	1.06	3 564	30	3h 51m	2 598	5.76	22.1	686.7	45.5	0.98	681.40	9.90
					16.4	1.20	2 968	30	3h 50m	2 610	6.02	23.0	828.8	46.0	0.85	681.40	9.90
					17.8	1.02	3 492	30	4h 1 m	2 302	7.12	26.5	841.1	45.4	0.99	816.63	10.80
F) Moine	Petrol	12	9 000	15	13.4	0.75	3 816	32	5h 4 m	1 960	5.45	27.6	—	—	—	—	—
G) Mack Island	Paraffin	20	13 800	17	13.1	1.14	3 816	30	3h 18m	3 090	6.93	22.8	970.0	54.5	1.06	1 028.48	12.71
					8.7	1.19	3 132	46	4h 23m	2 280	10.54	46.1	740.0	71.5	0.87	641.81	8.46
H) Petit Grant	Petrol	22	14 800	20	16.0	1.02	3 132	30	4h 13m	2 332	8.68	30.0	1 137.1	66.5	0.85	826.16	11.58
					18.5	1.04	2 540	34	3h 38m	1 776	7.12	42.0	1 331.2	74.5	1.16	870.35	11.72
					14.9	0.87	4 248	30	3h 59m	2 508	6.52	22.0	715.5	48.0	0.85	607.90	8.10
					16.2	0.92	3 060	30	4h 38m	2 016	5.58	27.6	Plough 822.8	46.1			
													Harrow 171.7	46.1			
I) Mogul	Paraffin	20	10 300	24 (*)	19.2	0.93	2 932	43	5h 23m	1 860	7.46	40.1	Total 904.5	0.82		815.59	10.87

(*) With a length of 2.50 metres and counting 30 minutes of work per hour, thus allowing for stoppages.
 (**) (1) Together with the harrow, the tractor turned 1.35 hectare, working on the machine turned on the harrow 0.15 hectare.

Repairs were made on: the fan-pinions; clutch leathers; 2 pinions and gear-wheel rim of the driving wheel (the first gears were replaced after ploughing 24 acres, the second after 27 acres); engine oil-pump; a connecting-rod head, axle-necks and hubs of front-wheels; new piston rings. These repairs cost about £ 55, or the high figure of 9s. 6d. per working day. A large part is due to bad and careless handling by the drivers.

The approximate net cost per acre, in 1916, was:

	£-s.-d.
A. — Lumpy clay loam, difficult; depth, 5 1/2 ins.	6-11-0
B. — Clay soil, dry, difficult; depth, 5 1/2 ins.	6-0-8
C. — Clay soil, worked under good conditions; depth, 6 to 6 1/2 ins.	6-0-6
D. — Clay soil, working easily; depth, 6 1/2 to 7 ins.	5-12-1

The Society is of the opinion that these cost prices for an acre are in no way excessive.

53 - **Internal Combustion Farm Drainage Machines.** — *Engineering*, Vol. CIV, No. 2966, p. 228 and pp. 237-238, fig. 5, London, August 31, 1917.

Especially in England, an immense amount of money has been invested in drainage, thus resulting in increased productivity. At present, drainage works are being carried out over large areas and, on account of the scarcity of labourers, machines have been made to remedy the difficulty. Fig. 1 shows the caterpillar type and Fig. 2 shows the ordinary tractor type of the drainage machines made by the PAWLING & HARNISCHKE Co. at Milwaukee, Wis., U. S. A. They are fitted either with a dredger or an excavating wheel, and have given most satisfactory results even in very difficult soils.

The chassis is mounted so as to permit free movement of the axle in passing over uneven ground without affecting the car body proper. It is of structural steel and is so designed that it supports the machinery without any overhanging or eccentric loading.

The machines are equipped to burn either gasoline, kerosene or motor oil and are provided with a 4-cylinder vertical engine. The internal-combustion engine is water-cooled and circulation is maintained by a centrifugal pump. The tanks are fitted with open screens to ensure better cooling, by exposing the water to the air in a thin sheet.

The machines are steered by means of worm and wheel gears on cross shafts which are chain-connected to the front axle.

The grading operations are controlled by power, by means of gearing connected through friction clutches to the hoisting drums. The excavating wheel is lowered by gear, and is controlled by automatic friction band brakes, which are lined with asbestos. The upright supports, cable sheave supports and connections for the excavating wheel frames are formed by placing 2 heavy channels back to back, a rigid construction that obviates the need for extension guides for the excavating wheel connections. The connection between the excavating wheel frame and the main body is very

strong; it insures facility in raising or lowering the excavating wheel and assists in maintaining a rigid position of the excavating wheel when oper-



Fig. I. — Caterpillar type.

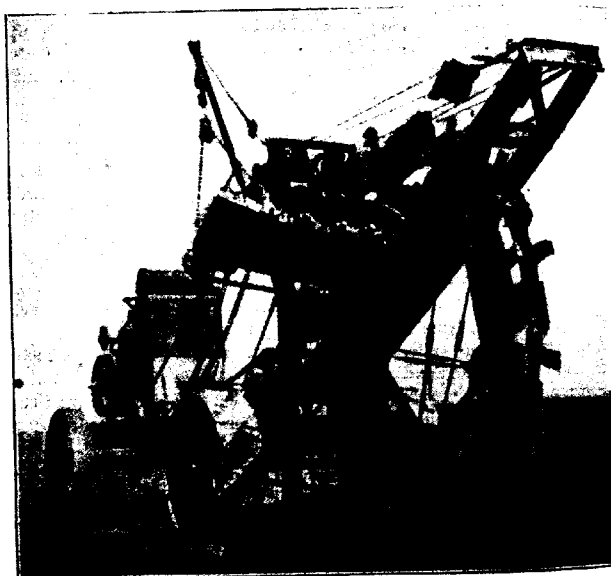


Fig. II. — Excavating wheel type.

ing in frost, cemented gravel or other hard digging. The excavating wheel frame is made of structural steel like the main car body and is very strong braced; a rigid and heavy construction in the rear is provided for attach-

cleaning guard and shoe. This gives great stability to the machine and prevents running sideways.

The excavating wheel has no axle and is so arranged as to obtain the maximum depth of trench with the minimum diameter of wheel. This member is made of machine-forged steel angles and plates. The driving ears are of cast steel and are fastened to the wheel member. The buckets are of heavy plough-steel plate, forged to shape and sharpened at the cutting edge.

The double spade cleaner is stationary, being mounted on the frame. These spades clean the bottom, side and top of the bucket. On the larger machines steel slat conveyors deliver the soil on both sides, but clear of the ditch. The conveyors are adjustable in length to suit the depth of the ditch being cut, and are driven from the main wheel driving shaft by a pair of bevel gears. The outer ends of the conveyor are adjustable for height. Ditches dug by these machines are easily back-filled by ploughing on first one side, then the other.

354 - **Harvesting with Tractors: Trials at Grignon, France, in 1917.** — BERTHAULT. P. in *Journal d'Agriculture pratique*, Year 81, No. 18, pp. 344-345, 2 fig. Paris, September 6, 1917.

Official tests of mechanical harvesters were held, on several days in August 1917, on the estate of the National School of Agriculture at Grignon and on neighbouring farms.

The following tractors were tested :

- 1) to H. P. AVERY, towing a 71 in. WOOD harvester-binder. Smooth working, fair result, doing good work.
- 2) to H. P. MOORE, with a 71 in. OSBORNE harvester-binder. Speed: 2.5 to 3.4 miles per hour, apparently suitable; work well done.
- 3) MOLINE with an 82 in. ADRIANCE-MOLINE binder. Work well done, driving easy even over difficult ground.
- 4) to H. P. CASE (of the Case Co. of France), with an 82 in. MASSEY-HARRIS machine.
- 5) AMANCO with a 71 in. MASSEY-HARRIS harvester-binder.
- 6) GLOBE (1), with a 71 in. MASSEY-HARRIS.
- 7) BLUM of Suresnes (Seine).
- 8) XAVIER CHARMES (Émile Mayen Co.).
- 9) FORD of Minneapolis, with a 71 in. WOOD binder.
- 10) BULL, with a 71 in. WOOD harvester.

The FORD tractor from Minneapolis should not be confused with the FORD tractor from Detroit which took part in the Noisy-le-Grand trials; in front it has two driving-wheels, between which is the engine; the steering wheel is in the rear and under the driver's seat.

(1) See Dr. CHAYEAT, *Notes de Culture Mécanique* (Paris, Baillière, 1917), from which the following data relating to this tractor are taken: Weight, 4730 lbs; 2 cylinder-horizontal engine; 18 H.P.; uses petrol; Dimensions, 11 ft. 8 in. X 6 ft. 9 in.; one front wheel and 2 driving-wheels; ploughing can be done with one driving wheel running on the stubble or in the straw previously turned. (Ed.)

Certain tractors could not continue owing to broken parts. Others worked equally well in wheat, barley and oats. Some were driven too quickly, which is bad, both for the machine and the crop to be gathered, the latter losing the grain on account of the shocks received.

The problem is not that of cutting very quickly, but rather that of cutting at the greatest speed permitting the work to be well done, with little loss of grain.

The Grignon trials showed that all the tractors could tow various makes of harvester-binder.

1055 - **The "Bell" Automatic Stooker.** - *The Implement and Machinery Review*, Vol. No. 509, p. 505, t. fig. London, September 1, 1917.

The stooking of grain involves considerable labour and expense, and in Canada and the United States the production of a simple and efficient stooker has long engaged the attention of many inventors. Mr. H. G. LANCASHIRE has recently invented a machine of this character, shown in the annexed illustration, which can be quickly attached to any make of binder without trouble and without in any way interfering with any working part of the binder.

The bundle carrier on the binder is first removed, and the machine is connected to the binder by means of two angle iron arms, the lower end of the conveyor being then situated immediately under the binder deck. The two arms projecting from the front and inner side of the machine frame are connected by bolt and clevis to the tongue of the binder; the by means of 4 bolts the binder and stoker are associated as one machine.

The conveyor is self-driven and receives the sheaves as they drop from the binder-deck, these being automatically deposited in the stook-forming basket, which is pivotally suspended between the drive wheel



The "Bell" automatic stooker.

When the driver has sufficient bundles in this basket, he can, by using the binder foot trip, throw the gears into contact, which causes the basket to revolve, the stook dropping on the ground and remaining so-
 ly fixed in the stubble; the basket returns by gravity to its original position. During the time required for this operation, the conveyor remains stationary, and will receive any sheaves which may leave the binder. The basket in finding its original position automatically starts up the conveyor so that the filling can go on as before. The upstanding curved arms seen on the sides of the basket close down immediately the dumping commences and grip the bundles, compressing them together into a solid stook; they release automatically as soon as the basket is in position to drop the stook to the ground.

1936 - **The Ventilation of Hay-Ricks.** — MANREN, G., in the *Journal d'Agriculture pratique*, Year 81, No. 18, p. 347, fig. 1. Paris, September 6, 1917.

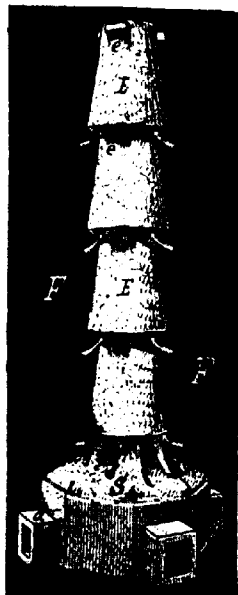
To allow of stacking hay while still damp, and still providing for sufficient drying to prevent heating, pieces of terra-cotta have been used for some little time in Switzerland.

The device, which is shown in the accompanying figure, is invented by A. BRÄNNER, of Thun (Switzerland), and is known as the BHA system. On the soil, in the middle of the site of the stack, a basal piece *S* is placed, having 4 horizontal openings to which are joined planks or sticks laid in rows. In measure as the stack *F* gradually rises, members *E* are placed one on top of the other, resting on 3 projections *c*, which project from the member immediately below. The members *E* are truncated cones, their internal diameter at the base being much greater than the external diameter of the top of the member placed below. Thus there is an annular space through which air, shown by arrows, can circulate, to pass up the chimney thus formed.

The radius of effect of these ventilators should not be greater than 13 feet; in oblong stacks the distance should be limited to 22 feet.

1937 - **A Milk-Cooler Fixed on a Trolley.** — *Ice and Cold Storage*, Vol. XX, No. 234, pp. 117-118, figs. 3. London, September 1917.

In order that milk should be delivered to the consumer in a pure, healthy condition, it is essential that it should be cooled as soon as it is taken from the cow, and before it is despatched to the centres of consumption.



Terra-cotta ventilators for hay-stacks

A simple and inexpensive milk-cooler constructed of tin plate is shown in the accompanying figures.

Fig. 1. shows a milk-receiving hopper *H* (removable) with perforation permitting the milk which has passed over the cloth strainer to flow on a conical-shaped surface *S*, the crushed ice being introduced into the bottom of the cooler by removing hopper *H*. *A* is a metal agitator to keep ice, or subsequently, water from melted ice, in circulation. These coolers can be fixed on a light trolley (fig. 2) for transport when the cows are milked in the field.

The most important advantage of this cooling system consists in the aeration of the warm milk. By circulating a thin film over the surface of the cooler, and by the milk being exposed to a pure atmosphere while it is still warm, all animal taint and odour from roots and other foods would be eliminated from the milk which would therefore considerably improve its keeping power.

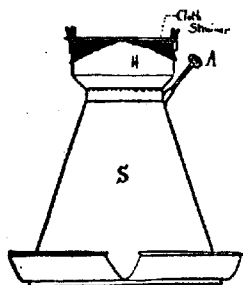


Fig. 1. — Milk-cooler: details of construction.

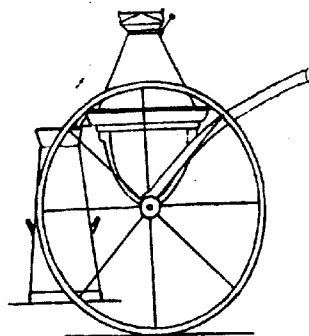


Fig. 2. — The same, mounted on wheels.

To carry out the low temperature cooling immediately after milking it is necessary that the farmer should be provided with ice. Thus there ought to be in each district a collecting and ice-making station possessing an ice-making plant of sufficient capacity to meet the requirements of the farmers cooperating in the district. At these collecting and ice-making stations situated at railway sidings, all the milk from the district would be collected, weighed and tested. The collection could be done by a motor lorry going the round of the farms. At the collecting stations, the milk could be further cooled if necessary, and then placed for transport in milk churns fitted with dippers provided with crushed ice and covers secured closed and sealed. From the collecting stations the milk could be sent to the distributing depot in the consuming centre, or large town, where there would be adequate plant for keeping the milk.

According to the article analysed, this method of milk distribution would be of considerable advantage to milk consumers in large towns.

258 - **Fuel Alcohol in Australia.** — *The Engineer*, Vol. CXXIV, No. 3222, pp. 278-279. London, September 28, 1917.

The Commonwealth Advisory Council of Science and Industry in Australia appointed a special Committee to investigate the whole question of alcohol and engines. The 1st. report of this Committee deals with the construction of an alcohol engine, the supply of alcohol and the denaturation process.

Alcohol engines are already made in America, England, France, and particularly in Germany. Any petrol engine of the ordinary types can be run on alcohol without material change in its construction, but the consumption of fuel per brake H. P. is about 50 per cent. greater than in the case of petrol. It appears, however, that the consumption of alcohol per brake H. P. in a specially designed alcohol engine will not exceed in volume the consumption of petrol in a petrol engine. The main alterations necessary in petrol engines to fit them to work on alcohol are: 1) an increased compression; 2) a pre-heating of either the fuel, or the air, or the mixture of air and fuel; 3) an increase in the area of the fuel jets and fuel supply pipes. In order to start an alcohol engine, the carburetter must be pre-heated, or use a small amount of petrol used. When a temperature sufficient to vaporise the fuel is attained, the alcohol can be gradually turned into the carburetter and the pre-heating of the fuel maintained by the exhaust gases.

The advantages of alcohol are: the products of combustion are practically odourless and free from smoke; the risks in manipulation are much less than when petrol is employed; there are many theoretical chemical and physical reasons why alcohol should yield superior results; there is no danger of pre-ignition under high compression; alcohol is more homogeneous than other fuels; alcohol can be produced in largely increased quantities in Australia.

As alcohol is more efficient in engines of low piston speed and long stroke, the Committee have decided to devote their attention to the design and manufacture of stationary engines.

The problem of distribution of alcohol is not likely to be so serious in the case of stationary engines as for the general adoption of the spirit for motor cars.

The supply of alcohol is the most difficult question, for even if the whole available supply of molasses in Australia were used for distillation, only about 4 million gallons of alcohol could be produced per annum, whereas the annual importations of petrol are about 17 million gallons. About 5000 tons of molasses are annually produced in Australia of which only a little more than $\frac{1}{10}$ is now used for making alcohol. The price of methyl alcohol produced from molasses is about 1s. 9d. per gallon. It appears unlikely that any considerable quantity of alcohol can be manufactured in Australia from either raw, or waste, substances such as waste wood, straw, or waste fruit; cereals or industrial plants such as potatoes and beets might, however, be used.

Various authorities have proposed that alcohol should be used as a fuel in admixture with other materials such as benzene, ether or acetylene.

The main advantage from such an admixture would be that the existing types of engines could be started without difficulty. A new fuel called "Natalite" is formed by a patented process in which the ether and alcohol are manufactured together in the form of a mixture, thus obviating the necessity for first producing the alcohol, and then manufacturing the ether from it. The Committee are making enquiries with a view to the production in Australia of suitable materials to be used as an admixture with alcohol and as to the efficiency of the various admixtures. The Committee suggest cooperation with the Imperial Motor Transport Council, London, for the purpose of obtaining a denaturant for alcohol which will be generally acceptable throughout the British Empire.

1059 - Review of Patents.

Tillage Machines and Implements.

Austria	74 354.	Device for raising and lowering tractor ploughs.
Italy	157 732.	Motorplough for hill sides with slopes up to 65 %.
Switzerland.	75 846.	Attachment for ploughs.
	75 934.	Power-driven agricultural implement.
United Kingdom	107 941.	Plough.
United States	1 235 795.	Agricultural implement.
	1 235 891.	Wheeled farming implement.
	1 236 252.	Plough.
	1 236 270.	Subsoiling attachment for breaking ploughs.
	1 236 344.	Detachable harrow-cultivator.
	1 236 713.	Plough shifter for traction engines.
	1 237 182.	Land roller.
	1 237 194.	Stalk cutter for maize.

Drainage and Irrigation.

Austria	74 282.	Device for preventing flooding, for draining flat soils and for utilizing watercourses on such lands.
	74 362.	Ditching machine for drainage.
United States	1 235 813.	Lawn or garden sprinkler.

Manures and Manure Distributors.

Austria	74 358.	Fertilizer-distributor.
United States	1 235 906.	Fertilizer composition.
	1 236 358.	Manure distributor.

Drills and Seeding machines.

United States	1 235 606.	Attachment for planters.
	1 235 892.	Lister.
	1 236 028 - 1 236 519.	Planting mechanism.
	1 236 377.	Planter.
	1 236 562.	Maize planter.

Various Cultural Operations.

Austria	74 219.	Clips for holding vine-shoots together and upright.
Switzerland	75 847.	Implement for lifting deep-rooted plants.
United States	1 235 700.	Garden-hoe.
	1 236 045.	Tool for side-grafting-trees and shrubbery.

Control of Diseases and Pests of Plants.

- 158 083. New spray for vines and olives against peronospora and other fungous diseases.
- 158 214. The use of trichloronitromethane $C = \angle \frac{NO_2}{Cl_3}$ (chloropicrin) for destroying plant and animal life deleterious to agriculture, commerce and hygiene.
- United Kingdom 107 651. Fumigator.
107 895. Animal traps.
- United States 1 236 629. Insect destroyer.

Reapers, Mowers and Harvesting Machines.

- United Kingdom 108 061. Swath turner.
- United States 1 235 601. Fruit picker.
1 235 649. Gang lawn mower.
1 235 977. Bundle-holder for binders.
1 236 018. Grain-shocker.
1 236 021. Harvester reel.
1 236 680. Shock forming and making machine.

Machines for Lifting Root Crops.

- United States 1 235 843. Beet-topping machine.
1 235 993. Beet pulling machine.

Threshing and Winnowing Machines.

- India 74 363. Tray seed dressing machine for separating round seeds from cereals and small leguminous seeds.
- United States 1 235 596 — 1 237 004. Grain separators.
1 235 899. Grain winnowing machine.
1 236 147. Cotton seed cleaner.

Machines and Implements for the Preparation and Storage of Grain, Fodder, &c.

- India 74 360. Regulator for setting knives of chaff cutters.
- United Kingdom 108 377. Hay cocker.
108 382. Elevator.
- United States 1 235 804. Hay-stacker.
1 235 893. Ensilage packer.
1 235 975. Hay-baler.

Forestry.

- United States 1 235 624. Tree-carrier.

Steering and Traction of Agricultural Machinery.

- Belgium 484 236. Tractor for use in vineyards.
- 157 276. Electric tractor for mechanical cultivators and inland navigation.
- United Kingdom 107 625. Tractor.
- United States 1 235 687. Steering mechanism for tractor engines.
1 235 822. Tractor.
1 235 888. Power steering attachment for traction engines.
1 235 915. Traction belt.
1 236 813. Automobile-tractor.

Feeding and Housing of Livestock.

Austria	74 218.	Horse shoe-nail.
Italy	158 065.	Immovable identification disk for cattle, which is applied by heat.
Switzerland	75 848.	Device to guide growing horns.
United Kingdom	107 941.	Horse-shoe.
United States	1 236 203.	Horse-shoe.

Poultry Farming.

United Kingdom	107 810.	Poultry feeder.
	108 415.	Poultry hopper.
United States	1 235 860.	Egg-tester.
	1 235 886.	Egg-carton.

Industries Depending on Plant Products.

Austria	74 379 — 74 380.	Apparatus for peeling and mashing potatoes.
United Kingdom	107 538.	Process for brewing light beers.
United States	1 235 722.	Machine for stemming cured tobacco-leaves.

Dairying.

Austria	74 325.	Open-air process for preparing dried milk on drying cylinder heated to boiling point, the milk being fed through a narrow slit.
Switzerland	75 873.	Churn.
	75 874 - 75 968 — 75 969.	Churns
	75 940.	Lock for milk cans used for transport.
United States	1 235 570.	Apparatus for sterilizing milk-cans.
	1 236 210.	Butter-cutter.
	1 236 413.	Apparatus for milking cows.
	1 237 093.	Dairy can.

Farm Buildings.

United States	1 235 533.	Post-hole digger.
	1 236 053.	Silo.

1060 - **Small Cold Storage and Dairy Buildings, in Canada.** — REDDICK, J. A. and B. GESS, J., in *Dominion of Canada, Department of Agriculture, Dairy and Cold Storage Branch Bulletin* No. 49, pp. 21, plans 7. Ottawa, February 6, 1917.

To reply to numerous requests for information respecting the construction of ice-houses and small cold storages coming from farmers, or producers, etc., a series of plans has been prepared to satisfy very varied conditions.

The 5 plans published refer to the following buildings.

- Plan No. I:* Milk platform with ice house and milk cooling tank.
- Plan No. II:* Ice house with dairy.
- Plan No. III:* Ice house with refrigerator and milk room.
- Plan No. IV:* Farm dairy with insulated ice house and refrigerator.
- Plan No. V:* Insulated ice house and refrigerator.

The plans (elevations and sections) give all details for construction as well as dimensions. Notes as to foundation, flooring, walls, roofing, etc.

and windows, are given with each plan. The work referred to is mainly in wood, but the instructions also apply to stone, brick or concrete buildings.

The vacant space between the double walls is no longer used, insulating material being now used to fill up the space between the walls. The width of the space depends on the insulating material used and on the temperature used in the cold-storage chamber. For a cold-store made of wood planer-mill shavings are the best insulating material to use.

They are cheap, elastic, do not settle readily, and can be obtained in a very dry condition, which is essential. Generally from 7 to 9 lbs. of shavings are required per cubic foot of space.

The shavings are cut from dry lumber, while sawdust is cut from green timber and is generally damp. This dampness destroys their insulating value and encourages the growth of mould and rot, causing a musty odour in the storage room.

It is absolutely necessary to provide against moisture being absorbed by the insulating materials, by using damp-proof paper between the sheathing or boarding of the walls. For brick, concrete, or stone buildings, similar insulating material should be used.

The walls should be given some water-proofing treatment to prevent the absorption of moisture. When shavings are used between brick or concrete walls, the inner surfaces should be coated with pitch, paraffin wax, etc. Tar should not be used, alone or in the pitch used on account of its odour.

The dimensions of the ice-chambers depend on the amount of ice used for the purpose of the refrigerator. One ton of ice measures about 35 cubic feet. A consumption of 2 cu. ft. (115 lbs.) per day for four months would amount to nearly seven tons. For such a quantity a building 10 ft square and 10 ft. high will afford ample space for that quantity of ice if properly packed.

Bulletin No. 36 of the Dominion of Canada, Department of Agriculture, Dairy and Cold Storage Series gives details of a more complete cold storage designed specially for creamery purposes. Blue prints of the plans described by the writers will be supplied free on application to the Dairy and Cold Storage Commissioner, Ottawa, Ontario, Canada.

RURAL ECONOMICS,

661 - A [Survey of Beet-Producing Districts in Minnesota. — PECK, F. W., in The University of Minnesota Agricultural Experiment Station, *Bulletin* 154, pp. 1-36, University Farm, St. Paul, Minn. February 1917.

The Minnesota Agricultural Experiment Station has been receiving numerous inquiries during the past years asking for definite and accurate knowledge of the cost of producing sugar beets and of the gross and net returns per acre, in order to understand the place of this crop in economic production. To obtain such information a survey was made in 1915 of the beet-producing districts in Minnesota. A representative of the Divi-

ion of Agronomy and Farm Management visited each beet-grower who has grown the crop before and obtained the data directly from him. A copy of the blanks used in this survey, reproduced in this bulletin, shows that the data were gathered on the normal acreage, yield, and labour requirement so that the results represent average costs and returns under average conditions.

To check the accuracy of the survey method of obtaining the 1914 normal acreages and yields for each farm, the figures given by the grower were compared with those of the sugar company, which were based on actual measurements of acreages and scale weight of beets marketed.

After carefully checking the computations for each grower a report of the result was sent to each, asking that corrections be made of any type which, to his knowledge, were not correct.

A copy of this report is given in this bulletin and shows the method of tabulating and reporting data, which include: *Cost per acre* of seed (stating quantity sown and price), fertilizer, man and horse labour (stating number of hours and price per hour), machinery charge, tax charge, and land rental charge, total cost, direct cost per ton, rental cost per ton, total cost per ton, *value of product per acre*: yield per acre in tons and price per ton, value of tops, total value of crops; *profit per acre*: total value per ton, cost per ton and profit per ton.

Man labour constitutes the largest single item of cost in the sugar beet crop, averaging 49.5 per cent. of the total cost of producing beets. The grower performs the labour without contract help an average of 155 hours per acre is required to grow the beets. At 15 cents per hour the man labour cost was \$ 23.31. The professional beet-worker performs the hand operations in 20 per cent. less time than the farmer. In other words, if the hand operations he is one-fifth more efficient on a basis of the actual time required.

Table I gives the hours of labour per acre of hand operations with contract labour (professional) and grower's labour:

TABLE I. — *Hours of Labour per Acre of Hand Operations* (1)

Operations		Contract Labour (Professional)	Grower's Labour
Bunching and thinning	Hours	31.57	44.35
Hoeing	"	25.51	20.07
Pulling and topping.	"	26.34	37.84
Total	"	83.42	102.26

The average cost per acre of contract labour at 20.6 cents per hour was \$ 17.19; for the grower's own labour at 15 cents per hour, \$ 15.45, and at 20 cents per hour, \$ 21.21.

Table II gives the number of hours of man and horse labour required in sugar beet production without contract labour:

(1) Acres considered: contract labour 680; grower's labour 462.

TABLE II — *Labour Requirements for Producing Sugar Beets (1).*

Operation	When performed	Total acres on which data are based	Hours per acre	
			Man	Horse
planting	Summer and autumn	833.9	9.9	21.7
hoing	Autumn	1426.0	4.4	13.1
disking	April-May	1134.0	2.3	8.2
harrowing	April-May	1451.4	1.1	2.9
banking	April-May	559.5	0.9	2.4
eeding	April 25-June 1	1458.4	1.3	2.6
cultivating	May 25 - Aug. 10	1447.4	11.1	17.2
weeding and thinning	June	462.1	11.2	—
hoeing	July	—	21.0	—
pulling and topping	October	—	57.8	—
lifting	October	1458.4	3.5	9.7
hauling	October 15-Nov. 15	1458.4	17.9	39.2
Total			155.4	110.7

According to Table I the professional beet-worker performed the bunching and thinning, the hoeing, pulling, and topping in 19.5 hours less than the farmer, thereby reducing the total man-hours per acre to 136. When professional beet-workers are employed the farmer performs all operations except those mentioned. The labour of the farmer amounts to but 52.5 hours, indicating that 66 per cent. of the labour is concerned with the three important hand operations.

Where the size of the farm permits, it seems best to grow a sufficient acreage of beets to employ outside labour for the hand operations, and to fit the cropping system to the time requirements so as to use man and horse labour on other crops when not demanded by the beet crop, which competes with corn in June and October and with hay and small grain in July. With the exception of marketing, the farmer's labour on beets is similar to that demanded by corn. Statistics indicate that about 31 hours of man labour and 52 hours of horse labour are required to produce an acre of corn. The agents of the sugar company estimate 7.5 acres of beets to each beet worker. This usually means that a family can care for from 15 to 20 acres.

In view of the special hand labour required and the competition with other farm crops, it is believed advisable to plant a sufficient acreage of beets to warrant the employment of special labour and to arrange for it through the sugar company.

Horse labour constitutes 21 per cent. of the cost of producing beets. The crop required 110.6 horse-hours per acre, costing \$ 11.06 at 10 cents an hour. Averaging all farms, with varying operations, gives a cost of \$ 9.97 per acre for horse labour. One third of the horse-time is spent in hauling beets to the loading station.

(1) Not contract labour.

The average rate of seeding was 17 pounds per acre with a seed cost 15 cents per pound. The cost per acre was \$ 2.57. Machinery cost varied with the use or non use of the manure spreader, but averaged \$ 1.21 per acre.

Taxes were higher on the farms studied than on average farms, because of their proximity to town. They averaged 77 cents per acre.

From 6 to 16 loads of manure were usually applied to the beet crop; the labour of application was the only charge made. This amounted \$ 3.66 per acre. Commercial fertilizer was applied in five of the eleven localities studied with no results in yields that are conclusive or even indicative of its value.

Land rental constitutes 15 per cent. of the total cost. The average cash rent paid and interest at 6 per cent. on owned land amounted to \$ 7 per acre.

The total cost per acre was \$ 47.65. On the average normal yield based on 9.82 tons per acre the cost was \$ 4.85 per ton. The receipts were \$ 15.45 in each case, leaving a profit of 15 cents per ton or \$ 1.45 per acre. In addition to the profit the producer received \$ 7.74 per acre of land rent and \$ 23.47 as pay for his own labour and that of his family, a total income, over other expenses, of \$ 32.50 per acre. Where contract labour was employed the producer had \$ 15.31 per acre for rent, for his own labour and for profit.

The yields varied from 5 to 22 tons per acre, with a normal average for three years of 9.82 tons. These were the actual scale weights from the sugar company books. The tops are a valuable by-product of the beet crop. Their value depends on the kind and quality of stock fed and the manner of storing and feeding. An average of the estimates of the growers was \$ 4 per acre.

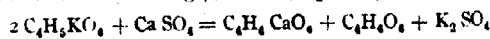
A great factor in the popularity of the sugar beets is the increase in grain yields the following year. Conservative estimates place the increase of wheat at 6 bushels per acre or over 30 per cent., and the increase of barley and oats at 4 to 6 bushels.

1062 - The Cost of Food in Egg Production. — See No. 1048 of this Review.

AGRICULTURAL INDUSTRIES.

1093 - Plastering of Grapes and the Increase of Acidity and Sulphates in the Wine. — BORTOLAZZO, A., in the *Giornale Viniçolo Italiano*, Year No. 35, pp. 412-414. Casale Monferrato, September 2, 1917.

It is well known that the addition of calcium sulphate to grapes at the time they are put in the vat causes an increase in the acidity of the wine. The reaction which takes place between the calcium sulphate and the cream of tartar is the following (CHANCEL's equation):



One molecule of free tartaric acid is, therefore, formed per 1 molecule of neutral potassium sulphate, i. e., 150 gm. of tartaric acid for 177.4

quate. In reality, however, the increase in acidity may be much below that corresponding to this ratio.

L. MAGNIER DE LA SOURCE attributes this fact to the presence, in the wine, of a large quantity of neutral potassium compounds, derived from organic acids other than tartaric acid, which are decomposed by the addition of calcium sulphate; he even admits the action of the colouring matter.

ROOS and THOMAS admit the presence, in wine, of a large number of organic potassium compounds, amongst which there are some whose part which represents the acid does not possess all the properties of acids properly speaking.

The difference between the true increase in acidity and the calculated increase in acidity was also present in experiments carried out by the Author with white "Catalanesca" grapes from Vesuvius. With the same kind of grape the Author prepared three wines: a natural wine (I) and two wines (II and III) containing different amounts of pure calcium sulphate free from carbonate or oxide. This experiment was repeated in 1914. In 1916 only two wines were made; one natural and one containing calcium sulphate.

After vatting and filtering, the sulphates (K_2SO_4) and total acidity expressed as free tartaric acid were determined in the 8 wines. The following results were obtained.

Wine		K_2SO_4 %			Acidity %	
		found	increase	calculated	found	difference
43	I	0.24	—	—	6.90	—
	II	2.99	2.75	9.27	7.40	1.87
	III	5.62	5.36	11.51	8.10	3.41
44	I	0.43	—	—	6.90	—
	II	3.70	3.37	8.63	8.50	0.40
	III	3.74	3.41	8.94	8.70	0.24
45	I	0.55	—	—	5.64	—
	II	5.98	5.43	10.31	6.28	4.03

The Author believes that the fact that, in the treatment of the grapes with calcium sulphate, the increase in the acidity of wine may be inferior to that corresponding to the increase of sulphates, may be explained less officially than has been done by MAGNIER and ROOS & THOMAS.

According to him the following are the 3 principal causes:

1) The tartaric acid liberated at the beginning reacts, in the presence of the alcohol and neutral potassium sulphate formed, on the neutral potassium compounds of other organic acids (malic, lactic, succinic, acetic) retained in the wine and, as a result of the precipitation of part of the cream of tartar (an acid salt) formed, the true acidity of the wine is inferior to that which would be found if all the tartaric acid remained in free solution.

2) Calcium sulphate is one of the sulphates which are determined in mass in wines treated with calcium sulphate and expressed as per 1000

of neutral potassium sulphate. Its solubility in water is greatly increased by the presence of certain neutral salts of potassium and organic acids, which are present in wine (malate, acetate, etc.). The tartrate acts on the acid group, transforming it into neutral potassium sulphate, while the calcium tartrate is precipitated. On the other hand, the increase in the solubility of calcium sulphate as a result of the presence of the free organic acids of the wine (e.g., tartaric, malic and acetic acids) is very slight or even negligible. 3) Tartaric, malic and acetic acids (in decreasing order of importance) slightly decrease the quantitative result of treatment with calcium sulphate where the sulphate content and the acidity of the filtered wine are concerned. This has been proved by the Author's experiments with cream of tartar, pure calcium sulphate, and with water in a quantity insufficient to dissolve all the bitartrate. On the other hand, their neutral salts increase the apparent calcium sulphate content, but increase the acidity to a much slighter extent. Tartrate, on the contrary, greatly diminished the acidity.

The Author's experiments show that only a part of the sulphates, wines treated with calcium sulphate really result from the action of the calcium sulphate on the cream of tartar and the formation of tartaric acid. A certain proportion of the sulphates (even of the calcium sulphate) dissolves without the formation of free acids.

1064 - **Wine Making Experiments with Sulphur Dioxide in Italy.**—MENSIO, C., in *Stazioni sperimentali agrarie italiane*, Vol. L, Pt. 6-7-8, pp. 300-314, 10 tables, Modena, 1915.

The author made many wine-making experiments with various similar products containing sulphur dioxide, phosphoric acid, ammoniacal nitrogen, etc. The products, sold under different names (biosulphite, sulphur phosphate, etc.), are recognised as being excellent substitutes for sulphur dioxide either as liquid, gas or combined, for example, as potassium metabisulphite.

The experiments were made with black grapes from Torre dei Passi which arrived in Asti after travelling for several days in baskets, and, consequently, were not only in fairly bad condition, but also contained an abundant cryptogamic flora. The author preferred to use such grapes rather than healthy ones, so as to observe the better the subsequent action of the sulphur compounds, more especially on the principal characteristics that is to say, the intensity and shade of the colour of the wine.

Five experiments were carried out, each with selected yeast and 1 hectolitre of grapes:

No. 1 — control; 1 hectolitre of grapes.

No. 2 — 1 hectolitre of grapes + 50 cc. of OTTAVI mixture.

No. 3 — 1 " " " + 50 cc. of HUBERT sulphurphosphate

No. 4 — 1 " " " + 50 cc. of JACQUEMIN bisulphite

No. 5 — 1 " " " + 25 cc. of potassium metabisulphite

Composition of the sulphur compounds used (in grammes per cc. of liquid)

	Ammonia	Sulphur Dioxide	Phosphoric Residue
OTTAVI	7.5 gr.	16.0 gr.	5.4 gr.
HUBERT	7.2	23.4	7.0
JACQUEMIN	1.8	15.1	3.7
METABISULPHITE	—	53.0 %	—

The results of the analyses of the wines obtained are given in 10 tables, and the conclusions drawn from them may be summarised as follows:

The most important result is that wines made with sulphur compounds have a brighter and more brilliant colour, and a greatly increased intensity of colour. If the intensity of colour of the control wine be placed at 100, that of wines Nos. 2 and 4 is 133, and that of wines Nos. 3 and 5, is 135 and 143 respectively.

Potassium metabisulphite is more efficacious than the other sulphur compounds, though only slightly so. This would seem to prove that the increase in colour is determined by the sulphur dioxide rather than by the phosphoric acid present in experiments Nos. 2, 3 and 4.

The use of sulphur compounds caused, as compared with the control:

increase in alcohol content of	0.2	to 0.3	cc. %
extracts of	1.6	to 2.7	grm. per litre
ash of	0.09	to 0.27	" " "
phosphoric residue (Nos. 2, 3 and 4)	0.020	to 0.050	" " "
sulphuric residue	0.037	to 0.054	" " "
total nitrogen (Nos. 2 and 3)	0.013	to 0.017	" " "

About 80 % of added sulphur dioxide remains in the wine. The greater part of this is combined (as a result of its action on the acetic aldehyde) under the form of acetaldehydic sulphurous acid, capable of setting free equivalent quantities of organic acids.

The glycerine content of all the wines is very low, the amount corresponding to 100 grm. of alcohol being only about 6.8 grm., that is to say, below what is usually considered the minimum.

There is no trace of ammonium salts in any of the wines, not even in Nos. 2, 3 and 4, which had received a small quantity of such salts in the sulphur compounds added.

The undetermined extracts amounted to about 5.5 to 6.5 grm. per litre.

The total acidity is higher in the wines made with sulphur compounds than in the control (3 to 4 cc. of N. solution more per litre). The same result was obtained for organic acids (2 to 6 cc. of N. solution more per litre). On the other hand, the volatile acidity is lower in such wines than in the control (2 to 3 cc. of N. solution less per litre).

All the results show that the use of sulphur dioxide under any form is very advantageous in wine-making.

Preparations containing sulphur dioxide combined with phosphoric acid and ammoniacal nitrogen, are not preferable to metabisulphite which, on the contrary, gives better results.

1065 - **The Substitution of Calcium Sulphite for Potassium Metabisulphite in Wine making.** - SANNINO, F. A., in *La Rivista di Viticoltura, Enologia ed Agraria*, Year XXIII, Series V, No. 19, pp. 330-331. Conegliano, October 1st., 1917.

As a result of the war and the consequent cessation of imports from Stassfurt, potassium salts have become very dear. For this reason the author studied the possibility of replacing potassium metabisulphite by other products capable of giving the same results (1). Besides sulphur dioxide prepared by burning sulphur, aqueous solution of sulphur dioxide and must containing a known quantity of either sulphur or anhydride, pure calcium sulphite may be used in musts rich in total or free acids.

In such musts, pure calcium sulphite (i. e. containing no calcium carbonate and 40 % of SO_2) decomposes rapidly and completely with formation of sulphur dioxide. It is necessary to use rather a larger quantity than would be required in the case of potassium metabisulphite (which contains 50 % of SO_2); for example, instead of 10 grms. of this latter salt per quintal of grapes, 15 grms. of pure calcium sulphite may be used.

1066 - **Morizot Acidimeter for the Rapid Determination of the Acidity of Musts and Wines.** - MORIZOT, P., in *Revue de Viticulture*, Year 24, Vol. XLVII, No. 121, pp. 216-219, 1 fig. Paris, October 4, 1917.

The new acidimeter consists of a graduated tube. Into one end, slightly larger in diameter than the graduated part, is poured the wine or must through the opening at the other end, till it reaches the line marked *te*. The space between this mark and the one immediately above it, which corresponds to *zero* is filled either with a few drops of some indicator or water. The graduated part above expresses the acidity in tartaric acid on one side and in sulphuric acid on the other. The open end of the tube is joined to small conical flask with a ground-glass joint.

The wine or must is measured in the tube as described and, for musts: white wines, phenolphthalein poured in up to the zero mark, or for red wine either water or a little calcium chloride solution. The flask is then joined on, and the apparatus turned upside down so that the liquid passes into the flask. The tube is left a few seconds above the flask to allow the liquid to drain well into it. The tube is then separated from the flask, to which an acidimetric solution is added without loss of time till the colour change. The flask is again joined to the tube, into which the liquid is repoured, at the acidity read off immediately. The exactitude of the results obtained is very satisfactory.

The acidimeter is very suitable for heating wines in order to expel the carbonic acid contained in new wines. The heating should be done in the flask, and, after cooling, it is well to verify the volume of the wine by passing it into the measuring tube and, if necessary, making it up to the original volume with a few drops of water.

The acidimeter is also well adapted to the estimation of the total acidity of vinegars, either during or after manufacture.

(1) As regards the substitution of sodium metabisulphite for potassium metabisulphite see, *R.*, August 1917, No 766. (Ed.)

The Degree of Bolting : Food Value and Digestibility of Bread, Better Utilisation of Wheat. — I. LAPICQUE, LOUIS, in *Comptes rendus des Séances de l'Académie des Sciences*, Vol. 165, No. 13, pp. 413-415. Paris, September 24, 1917. — II. BERTRAND, GABRIEL, *Ibid.*, Vol. 165, No. 14, pp. 438-440. Paris, October 1, 1917.

I. — It is frequently stated, especially now that the percentage of flour extracted from wheat has risen in France from 80 to 85 %, that the utilisation of wheat as a human foodstuff reaches its maximum when the extraction of flour is limited to the percentage which, if it does not supply a white bread, at least supplies a brown bread.

It is perfectly true that white bread, in equal weight, contains more nourishment than brown, and that brown bread contains more than that which all the bran is present. The food value of the wheat (in other words, the amount of human subsistence obtained from a given quantity of wheat) is, not the food value of the bread, but the product of this value by the quantity of bread obtained.

The Author's experiments gave, as general averages : 72 % white bread, 3 cal. per gramme ; Graham wholemeal bread, 3.3 cal. These are net calories, i. e. the difference between the combustion heat of the bread eaten and that of the actual or assumed corresponding faecal matter. In equal weights, wholemeal bread is the less nourishing. In proportion to equal weights of wheat, however, 72 % white bread gives 3.6 cal. $\times 72 = 259$ cal. of wholemeal bread, 3.3 cal. $\times 100 = 330$ cal. By extracting only 72 % there is a loss of 71 cal., or nearly 22 %.

For average wheat, 85 % bolting is certainly an advantage over any other percentage, but the experiments now in progress are not yet sufficiently advanced to determine the exact extent of this advantage. It seems that, the 5 parts added by raising the percentage from 80 to 85, 4 are effective, as improving the yield of the wheat by 5 %.

II. — Mr. GABRIEL BERTRAND criticises Mr. LAPICQUE's paper.

He calls *coefficients of digestibility* of wheat consumed as bread the products obtained by multiplying by the degree of bolting the figures which show the loss in substance and the loss in energy suffered by each flour in passage through the organism (losses calculated by chemical analyses and calorimetric determinations of the food and excreted matter).

The experiments carried out in America from 1899 to 1905 by SNYDER, KODS and MERRILL, confirm the chemical studies of GIRARD and FLEURY by proving clearly the superiority of white flour over those of a lower bolting percentage. The Author expresses his opinion on this subject as follows :

When passing from a white bread obtained from 72 % fine flour to brown bread made with 85 % flour, as is compulsory today, it is perfectly evident that there is an increase, in calories, in the coefficient of digestibility of wheat, of about 8 % in absolute value, or about 12 % in relative value. The advantage would appear to be with the flours with a high extraction percentage, but other considerations tend to reduce it to a marked extent.

In the first place, it is the bad quality of the grain which increases the

ratio of the weight of the husk to that of the kernel, then comes the increased work required for the digestion of food containing more inactive matter.

If the organism used everything which enters the alimentary canal for its nutrition, the coefficient of digestibility would merge with that which may be called the coefficient of utilisation, and the only interest to be considered would be the extraction of 85 % of flour from the grain instead of 72 %. But the American investigations have shown that, in 85 % bread the undigested part of the masticated food is 3 or 4 times greater than that of 72 % bread. The work lost in the mastication, reduction and intestinal transportation of this excess of inert substance has, naturally, to be deducted from the 8 % calculated above. It may, thus, be asked if the advantage gained is sufficiently great to counterbalance, on the one hand, the many disadvantages of 85 % bread, and, on the other, the decreased amount of food stuff available for farm animals as the result of so high an extraction percentage. This question is still undecided from a theoretical point of view.

By limiting the extraction to 80 parts of flour of the 100 parts of grain (with an assumed weight of 61.6 lbs. per bushel) a coefficient of digestibility of about 72 % would be obtained. This is very close to that of 85 % flour so that the coefficient of utilisation is about equal, and the greater part of the faults of the present day bread would be obviated, while the percentage of grain left for live-stock ($\frac{1}{3}$ in weight, and more in food value), a factor indispensable both to the food supply and agricultural production, would be greatly increased.

1068 - **Method for Estimating Bran in Flour and Bread.** — **LEGENDRE, R.**, in *Annales de falsifications et des fraudes*, Year 10, Nos. 105-106, pp. 293-296. Paris, July-August, 1917.

The method described is simple and rapid, and the only chemical required is 45° B. phosphoric acid, which isolates the fragments of cellulose. If the flour and the bread made from it are treated simultaneously for the same length of time, the amount of cellulose fragments obtained may be compared.

Two grammes of flour and three of bread-crumbs are weighed in order to allow for their difference in moisture content (flour : 10 to 15 % of water; fresh bread-crumbs : 40 to 45 %). Each sample is put into a test-tube in which are poured 10 cc. of water and 10 cc. of 45° B. phosphoric acid. The tubes are put in the autoclave at 120° F. and left there for an hour when they are taken out and left to cool. The contents of each tube are then poured on to a previously moistened No. 120 or 100 silk strainer, and the bran on the strainer is washed with water until the water from it is perfectly clear. The bran is then collected and poured into a test-tube, the strainer being put over a funnel which enters the tube, and washed with water from a pipette. The mixture is left till a deposit forms and then centrifuged. The two residues should be about equal in volume.

The same method may be used for paste and semolina, care being taken to soak them previously and to prolong the time during which they are autoclaved.

69 - **The Use of Brewers' Yeast in Bread-Making.** — BAKER, J., in the *Journal of the Society of Chemical Industry*, Vol. 36, No. 14, pp. 836-839. London, July 31, 1917, and in *Brasserie et Malterie*, Year 7, No. 13, pp. 198-203. Nancy, September 20, 1917.

Great economic advantages would be gained in bread-making by the use of brewers' yeast, which only costs £2 to £4 per ton whereas distillers' yeast which, before the war cost £30, now costs £100 per ton.

Experiments made with yeast from the different fermentation systems used in brewing are described.

Brewers' yeast may be used without any treatment, but, in this case, there is danger of a bitter taste; it is best to wash it with a very dilute solution of brine and to subject it to a short, but brisk fermentation in dilute mash-tun wort.

Yeast thus obtained may be used with distillers' yeast with satisfactory results. The proportion used may be 33 % or 50 %, according to the nature of bread. It is advisable to prolong the doughing period for about an hour. With the ordinary "quick doughing" process brewers' yeast by itself is useless, but it gives good results when used alone with the "slow doughing" process.

70 - **The Use of Calcium Glucosates in Bread-Making.** — LE ROY, G. A., in *Comptes Rendus des Séances de l'Académie des Sciences*, Vol. 165, No. 13, p. 416. Paris, September 24, 1917.

Calcium glucosates may advantageously be used in the place of lime-water in order to improve, from the point of view of taste, food value and spring quality, bread made with flour of a high bolting percentage, such as the 85 % flours compulsory in France at the present time.

The glucosates are prepared by the digestion, in the cold, of an aqueous solution of commercial glucose (free from the traces of arsenic sometimes found in these products) with milk of lime. After filtration a clear solution of glucosates is obtained which, according to the respective proportions used, contains 1 part of calcium to every 1 or 2 parts of glucose. As these solutions may be made fairly concentrated, they are easier to use in bread-making than lime-water, the aqueous solution of which can only contain not more than 1 gramme of calcium per litre.

In his experiments, the Author used for 100 kg. of 85 % flour kneaded with the usual quantities of water, yeast and common salt, quantities of glucosate solution representing 100 grm. of glucose and 50 grm. of calcium. This corresponds to about 1 grm. of glucose and 0.5 grm. of calcium per kg. of bread made.

The bread thus made was of a better quality than that made with lime-water under the same conditions. Fermentation, which appears to be slightly retarded with lime-water, seems, on the contrary, to be accelerated by the glucosate.

71 - **Beech-Oil.** — TRUILLÉ, A., in *La Vie agricole et rurale*, Year 7, No. 38, pp. 209-210. Paris, September 22, 1917.

The nuts of *Fagus sylvatica*, or common beech (Amentaceae), contain

from 15 to 20 % of edible oil, which, during the war at least, might be profitably extracted for use as a foodstuff. About half a century ago the extraction of this oil in Compiègne (France) was a fairly important source of income for the inhabitants. In good years a strong beech will yield 21 bushels of nuts, but a heavy yield is only obtained every four or five years. According to FORTIER, 1 acre of beeches may give about 56 bushels of nuts, that is to say, about 4 cwt. of oil.

The seeds are crushed in water (1 litre of water per 33 lbs. of kernels). The paste, subjected to pressure in the cold, yields 14 to 16 % of oil. The residue, collected in hot water and crushed again, gives 3 to 4 % of oil.

If, from the beginning the material is crushed when hot, 18 to 20 % more oil is obtained, but it is slightly bitter and of inferior quality.

The average yield for decorticated nuts is 15 %.

Beech-oil obtained from material treated in the cold is viscid, of a pale yellow colour, with a slight smell and a sweet taste. When extracted in the hot, it has a slightly bitter taste, which disappears with time, but which may be removed almost immediately by shaking with water, in which the bitter element is soluble. It keeps for a long time without changing, and even improves with age. It is edible. The worse quality oil is used especially for lighting and soap making.

Its density at 15° is 0.9205; rise of temperature with sulphuric acid + 65° polarisation = - 0.8° in saccharometric degrees; oleorefractometer + 16.5° to 18°; iodine index = 104.39; bromine index = 0.652.

There are two kinds of beechnut cake, one made from decorticated nuts (decorticated cake), the other from non-decorticated nuts (crude cake); the first kind is superior to the second in food value. Non-decorticated cake has a harmful effect on domestic animals, especially on horses, and should be used for manure or heating (being burnt in the same way as peat). Decorticated cake may be used as a foodstuff for domestic animals (1).

1072 - *A Coffee Substitute, Prepared from the Seeds of Cassia Tora.* - See No. 1022 of this Review.

1073 - *The Fibre of Hedychium coronarium as a Raw Material for Paper Making.* - See No. 1020 of this Review.

1074 - *The Sterilisation of Milk by the Lecomte Method; Tests made in Holland.* - I. *In en Uitvoer*, Year 2, No. 30, pp. 646-647, Amsterdam, July 25, 1917.
II. *Nederlandsche Weekblad voor Guisilberiding en Vedeelt*, Year 23, No. 19, p. 1. Doel chem, August 7, 1917.

The LECOMTE method of milk sterilisation consists in placing the milk in an hermetically sealed vat with a metal cover. By means of an air-oven pressor, there is passed through the vat a current of air at 2 atmospheres pressure from an apparatus ("transformator") in which the air is impregnated with an unspecified gaseous substance. The milk in the "impregnation" vat is not heated, but is subjected to the action of the cure

(1) See B. 1913, No. 957.

for 10 minutes. The milk is then put into bottles which are completely filled and closed with metal caps.

The bottles are then placed in an autoclave filled with water and heated to 115-120° C. When this temperature is reached the hot water is drawn off and a current of cold water passed through. In less than one minute the internal temperature drops to below 80° C. Cooling is continued, the cover then removed and the bottles taken from the autoclave. Milk thus treated has no boiled taste, but resembles fresh milk in every respect.

Experiments made in Dutch laboratories showed the milk to be sterile and free from antiseptic. Nevertheless, it is still necessary to investigate the behaviour of the vitamins and the value of milk thus sterilised from the point of view of digestibility. License to use the patent is granted by the "Society for Dairy Research and Dairy Apparatus" of Amsterdam on payment of 0.1 cent (1 cent = 0.20d. at par) per litre of milk treated.

Baron PEERS, of Belgium, after having assisted at a demonstration, stated that :

- 1) The milk after sterilisation at 115° C. had no boiled taste and no colour, and had the appearance of raw milk.
- 2) The apparatus is very simple.
- 3) The breakage of bottles is very slight; one or two per thousand.
- 4) The method is rapid (less than 1 hour the whole operation).

75 - **Cooling Milk on the Farm and the Organisation of its Subsequent Distribution by Means of Central Stations.** — See No. 1057 of this Review.

976 - **Cooling Milk on the Farm.** — HUNZIKER, O. F., MILLS, H. C. and SWITZER, H. B., in *Indiana Station Bulletin* No. 188, pp. 1087-1118, figs. 16. Lafayette, Indiana, 1916; Summarised in *Experiment Station Record U. S. Department of Agriculture*, Vol. 35, No. 9, pp. 871-875. Washington, D. C., 1917.

In order to test the effects of cooling cream, the writers used in their experiment 2 lots of cream of similar quality under similar sanitary conditions. One lot (cream A) was kept in cream-cooling tanks; for the other (cream B) no special cooling tanks were employed. During the experiments, the difference between the air temperature and that of the water used in the tanks was comparatively slight. Notwithstanding this fact, it was found that the use of the cooling tanks produced a very marked improvement in the quality of the cream and of the butter made therefrom. Cream A averaged 0.38 per cent. acidity and the butter gave 91.25 per cent. of fat, while cream B averaged 0.52 per cent. acidity and gave 88.75 per cent. of fat. It was noted that, while cream A had retained its clean flavour, cream B had in most cases a disagreeable taste. Bacteriological analysis showed that the average reduction of micro-organisms ascribed to the use of the cooling tanks was 35 per cent. of the total bacterial content; 35.8 per cent. of the lactic acid bacteria, 72 per cent. of the liquefiers, and 75 per cent. of the undesirable yeasts and moulds. In fermentation tests, cream A produced a solid curd with a sharp separation of clean whey; the majority of the fermentation tests from cream B showed a lumpy curd, and in some cases the curd underwent decomposition.

Analyses of all the experimental butter for moisture, salt and curd showed about the same average percentages for each lot of butter. Bacteriological analyses of butter showed the following reductions ascribed to the use of the cooling tank; total bacteria, 58.6 per cent., acidifiers, 60.2 per cent., liquefiers, 81.9 per cent., and yeasts and moulds, 87.4 per cent.

The average fat-content of the butter made from cream *B* was 88.98 % at the Station, and 87.69 a fortnight later at New York; and for the butter made from cream *A*, 91.63 % at the Station and 89.7 at New York. On the open market in New York, the price received for butter made from cream *A* was 24.88 cts. per pound, and for butter made from cream *B* 23.94 cts. per pound.

The writers point out the essential features of satisfactory cream cooling tanks, give notes on the use of springs and wells for cooling cream and describe several types of home-made and commercial cooling tanks.

1077 - Causes of Variation in Cream Tests. — WIANCKO, T. A. P., in *The Agricultural Journal of the Department of Agriculture of Victoria, R. C.*, Vol. 2, No. 5, pp. 86, 95, 98. Victoria, British Columbia, July 1917.

One of the most frequent causes for complaint by patrons of creameries is the frequent and almost unexplainable variations of the cream test which have in many cases led to lack of harmony between the patron and the creamery.

A great deal of this trouble arises from a lack of thorough understanding of the simple cause for these variations, and of the principles underlying the proper handling of the cream separator.

Factors affecting the percentage of fat in cream, other than possible inaccurate sampling and testing, may be summarized as follows:

- 1) Richness of the milk separated.
- 2) Changes in the temperature of the milk.
- 3) Speed of the separator-bowl.
- 4) Rate of inflow to the separator-bowl.
- 5) Amount of skim-milk or water used in flushing the separator-bowl.
- 6) Cleanliness of the separator.

Each of these factors is separately considered by the Author as follows:

1) It is a well known fact that the milk from the same herd will vary greatly from day to day; feed, care and handling being under the same conditions. There seems to be no accounting for these variations. They seem to be entirely owing to the temperamental individuality of each cow, varying from day to day and from one milking to another.

The influence of the fat-content of the milk on that of the cream is well shown by the following results of an experiment made in Indiana, U. S. A.:

Percentage Fat-content		
Milk	Cream	Skim-Milk
3.0	20.0	0.06
4.5	32.5	0.06
6.0	35.0	0.14

2) Milk should be separated when fresh and new, or at a temperature of 90-95° F. Milk at a lower temperature becomes thicker or more viscous than the same milk would be at a higher temperature, and will therefore not flow into the separator quite so readily, the centrifugal force being allowed to act on the milk for a longer time, narrowing the cream-line, which means less cream, but of a higher percentage of fat. The colder the milk, other conditions being equal, the richer the cream, because the same amount of force is applied to a smaller inflow.

The influence of the temperature on the fat-content of the cream is shown by experiments made in Indiana (U. S. A.) and Ottawa (Canada), the results of which are quoted below.

Influence of the temperature of the milk. Experiments made in Indiana.

	Temperature of milk	% Fat in Cream	% Fat in Skim-Milk
Lot 1	50-95° F	21.2	0.02
"	50-60° "	31.7	0.75
Lot 2	90° "	27.3	0.022
"	75° "	28.5	0.051
"	60° "	35.7	0.120

Influence of the temperature of the milk. Experiments made in Ottawa.

% Fat in Milk	Temperature of Milk	Lbs. Cream per 100 lbs. Milk		% Fat in Cream	% Fat in Skim Milk
		Lb.	oz.		
3.57	70° F	8	0	44.2	0.010
3.57	75°	8	14	40.0	0.033
3.57	80°	10	0	35.5	0.021
3.57	85°	10	11	33.1	0.028
3.57	90°	11	2	32.0	0.017
3.57	95°	12	2	29.3	0.021

This latter experiment gives a variation of 14.9 % fat in the test of the cream in these different lots of milk with all conditions the same except the temperature of the milk. The amount of cream per hundredweight of milk decreases with the temperature of the milk, while the percentage of fat lost in skim-milk increases with the low temperatures.

3) The effect of speed of the separator bowl on the percentage of fat in the cream is probably greater than any other cause. Variations in speed may cause a difference under ordinary conditions of from 5 to 20 per cent. at in the cream separated, the difference in richness being greater when the machine is set for thick cream than when set for thin cream.

Influence of the speed of the separator-bowl. Experiments made in Indiana.

		Speed of bowl	% Fat in Cream	% Fat in Skim-Milk
Lot 1	{	Normal Speed	28.5	0.029
		10 turns too high	32.0	0.029
		10 turns too low.	23.0	0.210
Lot 2	{	Normal Speed	42.2	0.060
		10 turns too high	51.0	0.040
		10 turns too low.	33.0	0.130

In Ottawa experiments, five turns per minute under the proper speed resulted in a difference of 6.7 %, and ten turns too low made a difference of 10.9 per cent. The difference in the test between five turns too fast and ten turns too slow was 17.4 per cent. Turning too slowly also increased the fat lost in the skim-milk. Both the turning movement and the speed should be very *regular*.

If from neglect the separator is not kept properly oiled and cleaned all its bearings it will gradually become harder to turn, and speed will keep up with much more difficulty, almost invariably resulting in cream with wider variations in the test because of a varying speed. An unbalanced bowl also tends to shake up the cream-line inside the bowl and yield a thinner cream and a consequent loss of fat in the skim milk.

Influence of the balancing of the bowl. Experiments made in Indiana

	Balanced bowl	Unbalanced bowl
Percentage of fat in cream	31.0%	28.30%
Percentage of fat in skim-milk	0.03	0.17

4) The amount of milk in the supply-tank affects the percentage of fat in the cream. The more milk in the tank the more rapid the influence caused by greater pressure, which consequently results in thinner cream.

Influence of the amount of milk in the tank. Experiments in Indiana

		% Fat in Cream	% Fat in Skim Milk
Lot 1	Normal flow.	44.3	0.000
	Small flow.	70.0	0.080
	Large flow.	32.8	0.100
Lot 2	Normal flow.	29.0	0.028
	Small flow.	30.0	0.027
	Large flow.	23.0	0.145

The above table shows a decrease of from 6 to 12 per cent. fat in the cream of the larger inflow over that of the normal inflow and a considerable loss of fat in the skim-milk from the large inflow.

5) A decrease of from one to ten per cent. fat in the cream may be caused by variations in the amount of flush-water or skim-milk used.

Influence of the amount of flush-water used. Experiments in Indiana.

Amount of flush-water	% Fat in Cream
None	37.4
Same as capacity of bowl	37.3
Enough to make cream discharge watery	35.0
Twice the last amount	33.5

6) When the separator is not kept properly cleaned after each time of using, it has a measurable effect upon the speed at which the milk flows through the machine, and when by reason of not being properly cleaned the skim-milk outlets become partially clogged with separator slime or other solid matter, more milk must pass through the cream-screw along with the cream, and in consequence will yield a lower testing cream.

CONCLUSION. The foregoing statements go to show that different conditions in the milk and even slight changes in operating the separator, without changing the cream-screw, cause the greatest variations in the percentage of fat in the cream.

The Revival of the Ensilage Question.— BURRI, R., in *Annuaire agricole de la Suisse*, Year XVIII, Pt. 1, pp. 9-14. Berne, 1917.

The preparation of compressed fodder, or sweet silage, has been known some time in Switzerland, but, recently a newly-awakened interest is being taken in it. This method of preserving fodder is only in general use in the United States, where it is employed chiefly for maize.

The introduction of this procedure into Swiss agriculture presents a problem which must be considered from various aspects: 1) scientific; 2) technical; 3) agricultural; 4) economical. These four aspects are considered in their most important details.

1) *Scientific*: — The conditions involving the minimum loss in food value; the bacterial action; the influence of the degree of moisture on the fodder to be preserved;

2) *Technical*: — The most satisfactory and most economical installation of silos; the practical use of existing buildings and of those to be erected;

3) *Agricultural*: — Labour; the influence of silage on the quality of the milk; the continuation of the results obtained by advocates of the new method;

4) *Economical*: — The influence of silage on the general health and breeding capacity of animals; the eventual detrimental influence on the quality of the milk, either from a hygienic point of view as a food for children and sick people, or from the point of view of manure, especially for exportation.

Only after the most important of these questions have been favourably solved can silage be prepared extensively. Of these questions two stand out and should be given precedence over the others. They are:

- 1) Would the introduction of silage, under the desired practical and scientific conditions, be of great economic advantage?
- 2) Is the milk obtained from byres where silage is fed throughout the winter suited to the manufacture of cheese, or would it increase the difficulties of manufacturing a uniform and first class product?

The second question, at least, has not yet been solved, and, considering the importance of the exportation of cheese in Switzerland, demands a thorough and comprehensive study.

The Swiss Agricultural Experiment Stations and Schools of Agriculture to which are attached farms, should all help to solve the problems arising from the introduction of silage; nevertheless, the conditions under which such institutions work are not identical with those found on farms. It is therefore, the results obtained by the many farmers who have adopted this method under varying conditions which will really permit of a solution of this problem. Experience only will solve the two chief questions, the financial value of the silage, and the value of the milk produced for the manufacture of cheese. Cheese factories using milk obtained from estates using silage should be under the scientific control of the Federal Establishment for the Milk Industry, and, eventually, also under the control of the county dairy stations. The cheeses made should, whenever desired, be thoroughly examined by representatives of the cheese trade and of the milk producers.

1079 - **Chemical Changes Observed in Silage in the United States.** — I. DOX, A. W. PLAINANCE, G. P. (Chemical Section, Iowa Agricultural Experiment Station), in *Journal of the American Chemical Society*, Vol. XXXIX, No. 9, pp. 2078-2087. Easton, Pa., September 1917. — II. PLAINANCE, G. P. (Id.), *Ibid.*, pp. 2087-2088.

In preceding publications (1) it was pointed out that the fundamental chemical changes to which silage owes its keeping properties consist in the conversion of the sugar present in the juice of the fresh plant into acid which inhibit the growth of putrefactive bacteria, and into carbon dioxide which expels the atmospheric oxygen and prevents the growth of mould.

In the continuation of their investigation on the fermentation phenomena that occur during the first 2 or 3 weeks after maize is put into the silo and on the products resulting from this fermentation, the writers have attempted to account, in part at least, for the soluble sugar which disappears, but cannot be recovered in the form of volatile acid, lactic acid, carbon dioxide and alcohol. The writers have proved that mannitol is a normal constituent of maize silage, as it is in silage made from other plants containing saccharose. Cane silage and sunflower silage contain mann

in much larger quantities. Mannitol is formed during the fermentation of ensilage by the bacterial reduction of the fructose-half of the saccharose molecule (1). It is produced in considerable quantity (to subsequently appear to a certain extent) at the same time as the above-mentioned characteristic constituents of silage (acetic and lactic acid, carbon dioxide and alcohol). Its presence accounts in large measure for the deficit noted when the sum of these products is balanced with the fermented sugar. The writers speak of the possible industrial utilisation of the mannitol thus produced, especially for explosives. It yields a nitration product very similar in properties to nitroglycerin. The average mannitol content of samples of maize silage was 1.88 per cent. on the dry basis and the experimental extraction of silage gave about 0.5 per cent. of mannitol.

In these experiments, no trace of mannitol could be found in sweet clover silage. Unlike other leguminous plants, sweet clover (*Melilotus alba*) may be ensiled without the addition of other plants to supply fermentable sugar (sweet clover silage is, however, at present little known). On the other hand, in the samples of sweet clover silage examined, the amount of leucine recovered ranged from 0.4 to 1.0 per cent. of the dry material. Leucine has not been recovered from any sample of maize silage and, as far as is known to the writer of the second paper analysed, its occurrence in silage has not been reported by any previous investigators.

2 - **Live Stock Market Review in the United States for 1916.** - NELSON, W. L., in *Missouri State Board of Agriculture, Monthly Bulletin*, Vol. XV, No. V, pp. 1-24. Columbia, Mo., May 1917.

The year 1916 in the live stock world was a very unusual one. The European war continued as a far reaching influence in the matter of prices. It is estimated that the exports of meats and meat products from the United States were worth about 275 million dollars. While smaller in volume the value was about 16 million dollars more, due to higher prices. A market which places the exports of beef and beef products at about 370 million pounds against 521.2 in 1915. The exports of pork and pork products, according to the same authority, were about 1500 million pounds against 39 in 1915.

Bacon exports are figured at 565 million pounds against 522.4 in 1915; ham and shoulder exports, 285 million pounds against 266.4 in 1915; lard, 10 million pounds against 451 in 1915. Mutton exports are said to have been about 5 million pounds against 4.2 in 1915. These are unofficial figures.

Due to the European demand for meat, a record price level of values in live stock was recorded in the United States.

These records were made, notwithstanding the fact that almost 40 million head of meat animals were handled at the five leading western markets - Kansas City, Chicago, Omaha, St. Louis and St. Joseph. Cattle receipts at these markets were 7 984 473; hogs, 20 539 142; sheep, 10 695 271. At

1 See R. July, 1917, No. 650.

(F.4.)

Kansas City 1916 top prices on the open market were : Steers, \$12; heifers, \$9.40; cows, \$8.75; heifers, \$11; calves, \$11.25; hogs, \$11.25; sheep, \$11.35; spring lambs, \$17 per hundredweight.

At this same market the average of monthly top prices shows : cattle \$10.53; hogs, \$10; sheep, \$9.82; lambs, \$12.05.

Some of the high records made on the St. Louis market for the year 1916 were : native yearlings, \$12.75; native heavy steers, \$12.60; native yearling heifers, \$9.85; native mixed steers and heifers, \$11.15; December lambs, \$13.55; sheep, \$9.25; hogs, \$11.50; veal calves, \$12.25 per hundredweight.

During the year 1916 many notable sales of cattle were made in Missouri, one of the leading live stock states.

The following figures serve to show the high quality of Missouri live stock. Six hundred and seventy-five Shorthorns averaged \$479 per head 1916 Herefords, \$497; 147 Angus, \$253; 58 Jerseys, \$337; 1838 Shorthorn Angus and Hereford, \$470 per head.

One new law of 1917 is of very great importance to the live stock grower and feeder — the "commercial feeding stuffs label and inspection law" requiring a tag showing feeding value on each bag, package or bulk sale.

The following is a summary of returns as made by county assessors showing number of live stock of various classes in Missouri on June 1, 1916

Horses	836 111
Mules	353 853
Asses and Jennets	11 511
Cattle	2 185 587
Sheep	536 750
Hogs	1 651 610
All other live stock	48 465

Cattle on June 1, 1915 numbered 1 879 729 head.

1081 - **The Texas Turkey Trade.** — *Ice and Cold Storage*, Vol. XX, No. 226, p. 6, London, January 1917.

The *National Provisioner* publishes a long article by Mr. W. D. HORSADAY on the trade in turkeys in Texas which, thanks to cold storage and refrigerator cars, has become one of the most prosperous industries of that State. It is estimated that the packing-house crop of turkeys amounted in 1917 to 1 800 000 birds, a substantial increase over the yield in 1916. Turkey rearing has much increased in the cotton growing region, and the farmers regard their flocks of turkeys as of as much importance as their hogs.

The market is no longer localised, but prices are regulated by nation-wide supply and demand.

The demand for turkeys is no longer limited to certain seasons; the birds are rapidly becoming a staple food product, and are in considerable request throughout the year.

The slaughtering and marketing season of turkeys begins usually the first week in November and ends on January 1st. The dressed fowls are stored by hundreds of thousands in refrigerating plants all over the country, and pass into the hands of retailers as the demand occurs. During the last season, there were probably more than 800 cars of dressed turkeys sent to the different markets of the United States, exclusive of the number the local markets required. Each car contained an average of about 100 barrels of turkeys, each holding about 22 birds. The average weight of each turkey when dressed was about 10 pounds. Thus the turkey crop which was marketed in car-lots amounted to about 1 760 000 fowls with an aggregate weight of 17 600 000 pounds. It is estimated that the farmers of Texas received at least £ 500 000 for that part of their last seasons' crop sent to distant markets. The total value of the turkey crop in 1915 was not less than £ 1 000 000. In Oklahoma, Kansas, New Mexico, Arizona, and California, the farmers are going into the industry on an extensive scale.

In order to prepare turkeys for the market, a large number of abattoirs and packing plants have been built in Texas during the last few years, and throughout the busy season they are working night and day. The large packers buy practically all the turkeys from the local merchants of the surrounding country and the shipment of live turkeys to the different plants is usually made by express or fast freight. The prices are quoted each morning. In many instances flocks of from a hundred to several thousand turkeys are driven overland for 30 miles or more to the nearest market. When they arrive at the packing plant, the turkeys are quickly killed and dressed. The packing plants each handle 2000 to 7000 turkeys per day. The birds are killed by piercing the brain with a needle which, it is claimed, is a painless process. The tail and wing feathers are put aside for the manufacture of feather dusters, and the body feathers are used for filling mattresses and beds.

The dressed turkeys were not only marketed in quantities last season in all the large towns of the United States, but were also sent to Canada and the North-West.

PLANT DISEASES

GENERAL INFORMATION.

1082. — **An Act to Eradicate *Eichornia crassipes*, a Troublesome Weed in Burma**
India (1). — *The Agricultural Journal of India*, Vol. XII, Part 2, pp. 333-335. Calcutta
1917.

Eichornia crassipes Solms (Water hyacinth), belonging to the family Pontederiaceae, has become a very serious pest in parts of India, especially Burma. In the former province, the weed is so wide-spread, that it has been found necessary to legislate against it, and the Water Hyacinth Act No. 1, 1917, providing for the destruction of the plant, and all its parts, has been passed in the Local Legislative Council.

This Act declares *Eichornia crassipes* to be a public nuisance in Burma; its provisions are as follows:

No person shall possess or keep the water hyacinth, and every owner or occupier shall destroy any water hyacinth growing in or on any place belonging to or occupied by him. Any person, who is duly authorised, may serve a notice on the owner or occupier of any place to destroy the water hyacinth growing thereon. Should such an owner or occupier fail to comply with this notice, the authorised person may enter upon such place and take all the measures necessary for the destruction of the water hyacinth without being liable for trespass, or for injury to crops, pasture or fisher rights; any person who possesses or keeps the water hyacinth, or fails to destroy it in accordance with the terms of this notice, is liable to a fine not exceeding one hundred rupees, or upon a second or subsequent conviction, to a fine not exceeding Rs. 500. The local Government may make rules for the purpose of carrying out the provisions of this Act. Further, with the sanction of the Governor-General in Council, the Local Government may apply all or any of the provisions of this Act to any weed or plant, or to the seed or any part of such weed or plant which in its opinion is noxious.

(1) See also, *B.* May 1911, No. 1399; *B.* August 1912, No. 1167; *B.* April 1913, No. 1000; *B.* August 1914, No. 798; *B.* June 1915, No. 600; *B.* September 1917, No. 798. (Ed.)

DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

1082 - *Investigations on the Dying-out of Pepper-Vines in the Dutch-East-Indies.* —
RUTGERS, A. A. L., in 'Mededeelingen van het Laboratorium voor Plantenziekten No. 27
— illustrations. Batavia 1917.

In a earlier report (1916), the author has given a description of pepper-cultivation at Banka. In this contribution are given the results of investigations on pepper-cultivation in the residency of Lampong districts situated in the far eastern part of Sumatra. Pepper has been the chief crop of Lampong (Sumatra) for centuries. It is cultivated now in the same parts of the Residency of the Lampongs as two hundred years ago. Half of the pepper produce of the Dutch-East-Indies comes from this Residency (about 12 million kg.).

Complaints are periodically heard about a decrease of pepper cultivation: these are especially frequent when many vines are dying owing to drought in times of high prices.

The last 50 years the prices of Lampong-pepper went down four times to 10 guilders and even less per pikol (60 kg.) and went up four times to 30 guilders, twice even to 40 guilders per pikol.

Three varieties are planted in Lampong: "lada boelak", "lada djambi" and "lada belantoeng".

Pepper cultivation in the Dutch East Indies has two distinct forms, on the one hand, the cultivation is that practised for many centuries by the Malay in Sumatra, a form of agriculture based on exhausting the virgin soil and leaving it alone afterwards; on the other hand the cultivation, is as practised by the Chinese, a refined form of horticulture. Pepper-cultivation in Lampong is of the first mentioned type.

The production of the vines averages about 1 $\frac{1}{2}$ lb. black pepper a year, the vines lasting for about 15 to 20 years.

Nematodes do not cause any disease. Nematodes are to be found everywhere in the roots, but they are practically harmless. Roots of 150 vines, for the greater part very fine ones, have been examined: in 150 Nematodes have been found; only in 9 these seemed not to be present.

Root fungus is present in rare cases.

The stem-disease from Malang (Java) has not been found in the Lampong districts.

Probably the fungus-threads in the vessels are quite harmless. Closer investigation is needed to make this point sure. Out of 140 vines the fungus has been found in 40.

Stem-borers and fruit-eating weevils are of minor importance in the Lampongs.

A pepper plantation is to be considered as dying out prematurely when the vines die before they are 15 years old, the symptom being usually a

gradual defoliation. Sometimes a plantation gets worse rather suddenly, a result of special circumstances (drought, heavy crop).

Premature dying-out cannot be explained by the action of parasites (nematodes, fungi, borers). The reason has to be looked for in the general state of cultivation of the pepper.

From the different diseases of dadap (*Erythrina*) only the stem-borer (*Batocera*) and the top-borers (*Terastia*) are locally important. These pests can be controlled by catching the *Batocera* or cutting out the larvae and by pruning the trees after the Lampong fashion, provided all cuttings are burned.

Dying out prematurely has been found only in the western and southern part of Lampong, where really good pepper soil is scarce now. Especially in well populated districts (Kalianda, Wai Lima) pepper is not being planted on soils which are not first rate and which have been planted with pepper before. At Tandjong Karang and in the Wai Lima district the difficulty to get suitable land for pepper is caused primarily by the number and extension of European estates. In the Wai Lima district 20 villas over a distance of nearly 20 miles have only at their disposition a strip of land from 1 to 3 km. deep. This must be insufficient, so that pepper cultivation in the Lampongs can be compared with tobacco cultivation in Deli as regards its want of land.

The pepper cultivation of Chinese and Bankanese at Banka shows that splendid pepper-vines are possible on soils where pepper is regularly dyed out before 10 years old, provided tillage, manuring and other measures are closely attended to.

In British India the conclusion has been the same: when there is virgin soil left, pepper cannot survive as a crop unless properly cultivated and well manured.

DISEASES DUE TO FUNGI. BACTERIA AND OTHER LOWER PLANTS.

1084 - **Fungi, Insects and Animals Injurious to Cultivated Plants, Observed in Denmark in 1916.** — LIND, J., ROSTRUP, S., and KÖLPIN, R. F., in *Tidskrift for Planteavl.* Vol. 24, Pt. 2, pp. 226-251. Copenhagen, 1917.

The annual report for 1916 of the Plant Pathology Station of Denmark records the following plant and animal pests:

WHEAT. — *Tilletia Caries* ("Hvedens Stinkbrand") has been reported all over the country; on an estate near Kjøgen, 75 % of the ears were attacked; *Puccinia glumarum* ("Hvedegulbrøst") did much damage to the "Tystofte Standhvede", "Svalds Sdhvede", "Glenne" and "Extra Squarehead" varieties, whereas "Tystofte Smalhvede" and "Wilhelmina II" were almost immune; *Leptosphaeria herpudricoides* ("Hvedens Fodlsyge") was active in low districts, its development being favoured by the damp, cold spring.

RYE. — *Urocystis occulta* ("Stengelbrand"); *Puccinia graminis* ("Sortrust"), in the districts of Askov, Lyngby and Orholm; *Claviceps purpurea* ("Meldrøjer"); *Leptosphaeria*

pythoides ("Rugens Halmbrækkersvamp"), common in soils rich in phosphorus (Himmerød, Holstebroegnen, Herningegnen).

BARLEY. — *Pleospora graminea* ("Stribesygge"), the attacks of which vary in intensity according to the variety; whereas, with "Prinzesse", only 1 to 2% of the plants were attacked, in other kinds the percentage rose to 20 to 40%; this was the case with the Danish barley, Karl, "Abel Juli", "Nørsløssvigs Kaempe", six-rowed "Tystolte" and "Erh. Frederikss Krydsrings"; *Ustilago nuda* ("Bygbrand") attacked 20% of the ears on an estate near Giv; *Puccinia anomala* ("Bygrust"); *Erysiphe graminis* ("Meldug") and *Leptosphaeria maculans* at Fyn and at Lolland-Falster.

GRASS. — *Septoria Avenae* ("Mørkpletsygge"); *Ustilago Avenae* ("Havrebrand") at Ask, Frederiksborg, Skelshøj; *Ust. Kollerii* ("Dækket Havrebrand") on a sample of "Graa Havre" received from the Faroe Islands; *Heterodera schachtii* var. *avenae* ("Havreæbles") appeared on islands towards the second half of May, and during June and July spread also to Jylland, but it caused great damage, not only to oats, but also to barley and wheat.

The presence of larvae, which, towards the end of spring or during summer, usually do great harm to cereals in Denmark, was also reported: *Hylemyia corticata* ("Kornets kærstue"); *Oscinia frit* ("Fritflue"), *Chlorops taeniosus* ("Bygflue"); *Hadena cecalis* ("Bibbeskægler"); *Tortrix fulvella* ("Timothe-Violeren"). In certain districts of Lolland-Falster, much harm was done to the wheat by *Contarinia tritici* and *C. aurantivitta*; less severe damage was also caused by *Sphenophora cerealis* ("Kornlus"); *Aphis avenae* ("Havrelus"); *Metopolophium didactymus* ("Rug-Blærefolien"); *Anthribus acuticollis* ("Aks-Blærefolien") and *Met. caelestem* ("Korn-Blærefolien").

The appearance of larvae of *Bibio hortulanus* ("Have-Haarmyggen") was reported for the same in Denmark at Mullerup, near Ullerlev.

MANGOLDS AND SUGAR BEETS. — *Phythora De Baryanum* ("Rodbrand"), and, in many cases, including the islands and Jylland, "mosaic disease."

Among the harmful larvae, the report mentions those of *Stilpa opaca* ("Aalselbille"), *Stenotaenia formica* ("Bedelue") and *Hydrocys micata*, observed near Korinth at the beginning of June; *Aphis baptyris* ("Bedelus") effectively suppressed with tobacco extract.

KOHLRABI AND TURNIPS. — *Phoma Nap brassicae* ("Kohlroettes Torfrotvædelse"); *Botrytis campestris* ("Brunbakteriøse"); *Bacillus carotivorius* ("Hvidbakteriøse"); *Albugo brassicae* ("Skulpesvamp"); *Plasmidiophora brassicae* ("Kaalbrokssvamp") in dissection, this parasite was previously unknown; near Krogeup in Stevns and near Lumby i Hjelshøjland; *Cylindrosporium brassicae* was reported in the Holstebro district; it caused lesions on leaves of *Brassica* spp. and had previously been found neither in Denmark nor in neighbouring countries; more or less serious damage was also caused by larvae of *Ceuthorrhynchus malvidens* ("Bladrippe Smuldbillen"), *Aphis brassicae* ("Kadlus"), *Meligethes cal.* ("Glimmerbøssen"); *Ceuthorrhynchus assimilis* ("Skulpe Smuldbillen"); *Phyllotreta vittula* and *Ph. atra* ("Jordloppeperne"); almost entirely absent: — *Pieris brassicae*, *P. rapae*, *Delia coarctatella* ("Kaalmal") and *Eurydema virgata*.

PEAS. — *Phytophthora viciae* ("Kartoffelskimmeln"); *Bacillus phytophthora viticola* in Jylland and the Faroe Islands; *Spongospora subterranea* ("Pulverskurv"), i Holstebro and in the Faroe Islands; *Cercospora ciceris* near Studsgård and Birkebaek, leaves whole still green; *Mycosphaera fabae* (?) ("Kartoffelrus"), near Aarhus and Lynby, the flowers.

BEANS. — *Sclerotinia Trifoliorum* ("Kloverens Reversvamp"); among the insects larvae of *Phytomyza mercurialis* ("Klovergnaven"); *Stenotaenia lineata* ("Bladribiller"); *Sphenophora pisi* ("Bladlus"); as usual, great damage was caused by *Eutrichus deasei*.

TURNIPS. — *Phythora De Baryanum* ("Rodbrand"), at Viborg and Grenaa; *Sclerotinia bitorum*, among the insects: larvae of *Phytomyza variabilis* ("Lacernegnaveren") at Lolland-Falster and Næstved; these, however, were attacked and killed in large numbers by

Entomophthora Phytomyi; *Cucurhinus exaratus* ("Snudebille"), observed in lettuce fields near the Stubbgaard Experimental Station.

FORAGE CROPS.—*Nectria graminicola* ("Sneskimmel"); *Epichloe typhina* ("Svovelsvamp"); *Ustilago perennis* ("Draophvrebland"); *U. bromivora* ("Heinebrand"); *Aplanobacter Reithyi* ("Hundegrassbakteriose"); *Uromyces Poae* ("Ruggræsruget"); *Puccinia Arrhenioi* ("Draophværest"); the appearance of the larvae of *Cleigastra flavipes* ("Timothelien") was reported in June near Lyngby, and, on July 16, in the same district, large numbers of *Forficula auricularia* ("Orentviste") were seen in the fields of Timothy grass.

Some animal pests, instead of confining themselves to one specified plant or group of plants, attack and injure many crops or all crops in general. They may be divided in four groups: 1) insect larvae; 2) gastropods; 3) birds; 4) rodents.

The larvae of *Agrotis segetum*, of *A. tritici* ("Hvedeuglen"), of *Agrotis lineatus* ("Sander"), damaged cereals, vegetables, beets, etc. in many districts, both in the peninsula and the islands. Numerous larvae of *Melolontha vulgaris* ("Jordenborre") were reported near Lyhus, at Lolland-Falster and in the district of Vordingborg; in many places (Grindsted, Ribe, Herning) the oats, wheat and rye suffered from attacks of *Tipula paludosa*, the larvae of which greedily devour the green part of the young plants.

Owing to the damp, cold season *Agriolimax agrestis* ("Agersneglen"), spread everywhere and damaged the cabbages and forage plants (Gramineae and Leguminosae), and also caused considerable loss in the beet, carrot (Lyngby) and potato (Aarhus) fields.

Corvus frugilegus ("Ranger") completely destroyed a maize field near Sorø; *Colinus oenas* caused damage to the barley fields at Lyngby; and, finally, *Passer domesticus* ("Sparre") did damage to kitchen gardens and seed-plots.

Arvicola agrestis ("Markmus") injured winter cereals in the Lyngtor district and potatoes in the Sølling district. *Mus decumanus* ("Rotter") attacked barley in the Fånsø Islands. *Talpa europaea* ("Muldvarene") and *Lepus europaeus* ("Hare") did damage here and there to meadows, oats, barley and root-crops.

The methods of control, used against the fungoid parasites and the animal pests of the various crops, are described.

1085 — **Nigerian Fungi** (1). — WAKFIELD, E. M., in *Royal Botanic Gardens, Kew, Bull. of Miscellaneous Information*, No. 3, pp. 105-111. London, 1917.

This paper gives a list of 38 fungi collected by Mr. C. O. FARQUHARSON in South Nigeria during the period 1914-1916. Six species are new to science.

The only fungus in the list known to be of economic importance, the pyrenomyceete *Ustilina zonata* (Lév.) Sacc., recognised in 1914 as the cause of a distinct disease of *Hevea brasiliensis* at Calabar.

The same parasite has long been reported on the same plant host in the Federated Malay States (2).

1086 — **Soil Fungi Injurious to Cultivated Plants in the New York Botanical Garden** — SEEVER, P. L., in *Journal of the New York Botanical Garden*, Vol. XVIII, No. 1, pp. 186-188. Lancaster, Pa., 1917.

A considerable amount of damage has been noted recently among various plants of the New York Botanical Garden, and this injury is

(1) See also *B. Sept.*, 1913, No. 1107. — (2) See *B. Sept.*, 1915, No. 981 and *R. Ind.* 1916, No. 812.

U. zonata has since been reported on *Hevea* in the island of Sumatra. Cfr. *R. No.* 1916, No. 1234.

arently been caused by the presence of fungi which normally inhabit the humus of the soil.

The attention of the writer has especially been called to a bed of *Fumaria* in which about one-third of the foliage was dead. The examination of the leaves of these plants, while showing slight traces of fungus mycelium and spores, as is usual on dead plant tissues, did not reveal any particular species present in sufficient abundance to account for the death of the plants. A careful examination of the soil about the bases of these plants, however, revealed the presence of a fungus belonging to the genus *Sclerotium* which apparently attacked the plants through the medium of the soil. The fungus appeared to be *Sclerotium Semen* Tode, a species which commonly occurs on dead leaves and in the humus of the soil.

The writer also observed on tulip bulbs the presence of *Scl. Tulipae* Fry, which appeared to be accountable for the failure to bloom of the bulbs produced from such bulbs. There is reason to suspect that the origin of infection is the same in both cases.

Still another fungus which has ordinarily passed as a saprophyte has been found to attack the root-stocks of the wild geranium, causing their decay. Laboratory experiments have been carried out in order to determine the life history and habits of the latter species, and the results of these experiments will shortly be published.

11. Over-Wintering of the Apple-Scab Fungus, *Venturia inequalis*, in Canada (1). — FRASER, W. P., in *Science, New Series*, Vol. XLVI, No. 1186, pp. 280-282, Lancaster, Pa., 1917.

Though it is generally known that the scab-disease of the apple caused by the fungus *Venturia inequalis* sometimes attacks the young twigs of susceptible varieties of the apple, yet not much has been published on this side of the disease in North America.

MORSE and DARROWS have shown that the conidia of this fungus survive the winter on apple twigs and germinated readily in the spring. They find no evidence, however, that the mycelium exists during the winter as living stroma and produces conidia in the spring. WALLACE also reviews the literature on the persistence of the stroma on the twigs and the hibernation of the conidia, and is convinced that twig infection is not of common occurrence, and that the conidia cannot withstand winter temperatures.

The writer's attention was first called to scab-disease on the young shoots of the apple in the autumn of 1915, when a number of badly diseased twigs of a McIntosh apple tree were sent for determination by Dr. E. W. MERRISON, of Masonville (Quebec). The twigs were defoliated for several inches from the tips and the leaves that remained below showed a very severe attack of scab. The twigs were severely injured, many of them being in a dying condition. The bark was studded with the pustules of the scab-disease

(1) See also *B. March* 1911, Nos. 1021-1024; *B. June* 1911, No. 1368; *B. April* 1913, 231; *B. June* 1913, No. 756; *B. October* 1913, No. 1210; *B. October* 1914, No. 950; *B. July* 1915, No. 183; *B. December* 1915, No. 1350; *R. May* 1916, No. 577. (Ed.).

and abundant conidia were present. Another collection was sent by Dr. HENDERSON a few weeks later, but many of the twigs were now dead and few conidia remained.

Another collection of diseased twigs was received about April 1, from Prof. SHAW, collected at Truro Agricultural College N. S., also from a McIntosh tree. Many of these twigs were killed back several inches, while abundant pustules of the scab were present in both dead and living bark.

The affected twigs showed the characteristics described by MORGAN and DARROWS. The bark was more or less thickly studded with light brown spots which examination showed to be blister-like areas due to the dead and pushing out of the epidermis of the twigs. Many of these light brown areas were roundish, or oval, with a dark centre. A number, however, lacked the dark central area. Pieces of the diseased bark were removed, embedded in paraffin, and sectioned, and the sections and diseased twigs examined. A well developed stroma was present, with many conidia beneath the raised epidermis. The dark centre was composed chiefly of the conidiophores of the fungus, the exposed conidia having fallen away.

Dr. HENDERSON and Prof. SHAW were asked to forward diseased twigs collected about blossoming time. The collection from Prof. SHAW was received about June 1st. A few inches of the tips of some of the twigs were dead but the bark of the living parts and of the living twigs contained many scattered pustules of the apple scab actively producing conidia, the pustules being olive-green from the abundant conidia. The dead parts of the twigs were thickly covered with scab pustules from the previous season, but the stroma were dead, or not producing conidia.

Fresh conidia, placed in hanging drops of distilled water, germinated freely and vigorously as conidia obtained a short time later from the young leaves of an apple in the orchard. Pieces of the bark containing live pustules were fixed, embedded in paraffin, and sectioned. The stroma was very well developed, reaching a maximum thickness of 200 μ , while the maximum thickness of the stroma on the fruit was about 55 μ . It was also evident that the stroma was actively producing conidia at the time of fixation.

In 1915, Mr. A. G. TURNEY described the scab as being troublesome on the twigs of susceptible varieties, and states that in one orchard all the twigs of the previous year's growth of the Fameuse were covered with scab spots. He also found the amount of scab on the fruit was much reduced by trimming off the diseased twigs early in the spring. He had previously failed to control scab in this orchard by spraying. Mr. TURNEY states, in a letter to the writer, that the scab is quite common in the coastal regions as a twofold infestation, and it may be found also in almost any orchard inland but rarely so bad as to be a serious hindrance to growth.

Prof. SHAW has informed the writer that he found severe twig injury from scab in several different regions in Nova Scotia. The twigs collected at Mansonville, Quebec, at blossoming time by Dr. HENDERSON did not show any living pustules, but as few of them had been cut back into the living wood, the negative evidence was not satisfactory.

The twigs that had been received from Truro, N. S. about April 1

re left about 8 weeks in the laboratory under ordinary conditions. Conidia were then taken from the scabbed areas and were tested in hanging drops of distilled water for germination. A small percentage was found to germinate. A second test gave the same result. The spores were taken from beneath the blistered bark, so that they had a certain amount of protection from the cold and from drying.

The writer is convinced from these experiments and observations that, in certain regions near the coast, apple scab may winter on the twigs of susceptible varieties such as "Fameuse" and McIntosh as a dormant stroma. It produces abundant conidia in the spring. He also confirms MORSE and FROW'S conclusion that, under certain conditions, and with certain varieties of apple, diseased twigs and rain may be an important factor in the propagation and spread of the disease.

J. S. DASH, who has devoted some time at Quebec to the study of apple scab, collected scabby apples early in the spring that had lain under the snow all the winter, and found that about 5 to 10 per cent. of the conidia germinated.

On November 27, 1916, the writer collected scabby apples that had remained under the trees after their fall without protection of any kind. During late autumn, and early winter, the temperature fell below the freezing point 15 times, rising above it during the day.

There were 2 periods of severe frost followed by mild weather, the minimum temperature of the first being 11° F., and of the second (November 19) 19° F. Conidia were abundant on the scab spots and these were placed in hanging drops of distilled water. The spores germinated vigorously and in 24 hours showed many germ-tubes over 100 μ in length.

More than 26 per cent. of the conidia placed in hanging drops of distilled water germinated. Only those with well-developed germ-tubes were counted. There could be no doubt whatever that the germ-tubes had developed while in the water.

It would seem from these observations, that the conidia are more resistant to low temperatures than is generally supposed. The writer hopes to carry on further experiments along this line during the winter and spring.

1 - **The Presence of Nitrites and Ammonia in Diseased Plants.** - See No. 1000 of this Review.

2 - **Hypothesis to explain the Resistance of Wheat to Rust.** - See No. 1010 of this Review.

3 - **Resistance of Hybrid Direct Bearers to Diseases.** - See No. 1021, R. August 1917 and No. 1026 of this Review.

4 - **Patents for the Control of Diseases and Pests of Plants.** - See No. 1030 of this Review.

1092 - **Fungous Diseases of Wheat in the Argentine.** — See No. 1016 of this Review.

1093 - ***Aplanobacter Rathayi* Injurious to *Dactylis glomerata* in Denmark.** — LIND, J., in *Tidsskrift for Planteavl*, Vol. 24, Pt. 2, pp. 255-263. Copenhagen, 1917.

Aplanobacter Rathayi, studied and described for the first time by ERIC RATHAY, who discovered it on infected plants in a wood near Vien (1897-1899), causes bacteriosis of *Dactylis glomerata* L. (Cocksfoot). In 1901 after having occurred here and there to a limited extent, it suddenly spread with marked virulence through various districts of Denmark. The attacks were repeated with great frequency and intensity the following years. The gelatinous masses of bacteria adhere to the panicles of *Dactylis* thus preventing its proper development. During rain they are dissolved and flow down the leaves and culms, even infecting neighbouring plants. The Author studied the disease from 1912 to 1916 and came to the following conclusions:

- 1) The bacteriosis is introduced and spread by infected caryops. If the seed from fields infected with *Aplanobacter* be examined, caryops are often found completely filled with a small gelatinous mass, formed by the bacterium, which, under favourable conditions of moisture and temperature, develops with great rapidity;
- 2) wind does not help to spread the disease. Healthy plants may be infected by direct contact with diseased specimens, especially during rains;
- 3) when infection has occurred the plant retains the bacteria for a long time; thus, in the same soil, the epidemic persists from year to year with an intensity varying according to the meteorological factors;
- 4) abundant nitrogenous manuring seems to attenuate the damage caused by *Aplanobacter* and to hinder its spreading; but sufficient data are lacking to confirm this;
- 5) the most efficacious method of controlling the disease is to use seed from immune districts.

1094 - ***Phytophthora Faberi*, the Cause of Hevea Canker.** — RUTGERS, A. A. L. *Mededeelingen van het Laboratorium voor Plantenziekten*, No. 28, Illustrations 18-20, 1917.

I. — The first paragraph gives the contents of the preliminary reports of 1912 and 1913; the former of which, treating of the form of canker known as "canker-patches", can be summarised as follows.

Hevea-canker has been found in Java, Sumatra and Borneo.

The systems of canker appear in the following order:

- 1) The disease is usually discovered by the cessation of the latex flow.
- 2) In the outer bark claret-coloured patches are to be seen, where the cork-layers of the bark are shayed off. In many cases these patches begin at the cuts and run downwards.
- 3) A discoloration sets in of the inner layers of the cortex which become greyish or slightly brown-coloured just outside the cambium.

discoloration starts from the claret-coloured patches, but extends over a larger area and subsists after the disappearance of the patches.

4) Woody tissue is formed round the dead brown cells in the inner cortex, by the action of a secondary or wound cambium. This formation of wood in the cortex goes on for several months, perhaps for years after the canker-infection is over.

The measures advisable to get rid of the canker are the following:

1) The humidity of the plantation should be decreased and free access to air and sunlight provided; for this purpose removing the inter-crops, thinning-out and pruning the trees, or draining, may be advisable according to circumstances.

2) Cut out thoroughly all diseased tissues of the cortex but leave the cambium undisturbed. Train a special gang of labourers for this work.

3) Disinfect the tap-knives by means of formalin and spray the stems with Bordeaux mixture. (Disinfection and spraying in this way are no longer used in Java).

The second report (1913), treats of "stripe-canker", a form of canker unknown before.

This form of canker shows a decay of the renewing bark and is only to be found in the rainy season in very wet weather. The decay is first indicated by the appearance of vertical black lines just above the tapping cut. These black lines, very thin at first, soon become larger and fuse with the neighbouring ones. The whole of the renewing bark can decay in this way. Occasionally transition stages between this form of canker and the ordinary canker patches are found. The disease spreads exceptionally quickly; the use of water on the tapping cuts must have been the cause. The damage was serious; out of 10,000 8-year old trees, 6,000 were so seriously diseased, that tapping had to be stopped.

The only curative measure was the application of Carbolineum Plantation diluted with water. (It was used in 50% strength at first, now 20% instead, and probably a lower percentage, say 5%, would do as well).

II. - A series of infection experiments has proved conclusively that both canker patches and stripe-canker are caused by *Phytophthora Faberi* Lebl.

The canker patches could be obtained artificially by putting some mycelium into an incision in the old bark, and stripe-canker by bringing a suspension of conidia in water on the newly opened tapping-cut. Controls were made with clean water.

In order to obtain canker patches six infection experiments with a total of 56 infections have been made; 48 were successful. Of the infections made in the rainy season and protected against drying out, 100% were successful; the control cuts always remained free from infection.

As to stripe-canker, five experiments with a total of 76 infections have been made to prove definitively that this form of canker is caused by *Phytophthora* as well; altogether 61 have been successful, the remaining ones being exposed to sunshine (in one case) or being made on tapping cuts that had not been opened for several days (in 14 cases). Provided the tapping

cuts were opened daily and were not exposed to sunshine the infections were successful without a single exception. The control cuts remained free of infection.

PETCH and BANCROFT have recorded stripe canker from Ceylon and F. M. S. as well. PETCH says the phenomenon is probably due to excessive moisture. The above mentioned experiments not only show that *Phytophthora* is the real cause, but the controls, where pure water was used also prove that excessive moisture alone is not sufficient to cause the decay of the renewing bark.

III. — The progress of the disease was studied in detail on 33 cankers on Hevea-trees in the experimental garden of the Laboratory for Agriculture Chemistry at Buitenzorg. The trees were under observation during two years. The red canker patches disappeared wholly during that period; the burrs, on the contrary, increased in number and size, or appeared on trees which were originally free from burrs and had only a canker patch. The other trees in the garden, where no symptoms of canker had been found remained free from burrs.

Apart from this direct proof that burr-formation is a symptom of canker, further evidence is given by the fact that burred trees are to be found only on estates where canker has been prevalent, and that no new burred trees are added to the existing ones, when adequate measures against canker are adopted.

Treatment of a part of the above named trees lead to the following conclusion: under the favourable circumstances of the experimental garden light attacks recovered by themselves, provided tapping was stopped; severe attacks, when not treated, recovered only in exceptional cases, but by shaving all diseased bark, 5 out of 8 badly diseased trees recovered.

IV. — Comparison of pure cultures of six species of *Phytophthora* showed that morphologically *P. faberi* (from Cacao, Hevea and nutmeg), *P. Nectrianae* (from tobacco), *P. Colocasiae* (from *Colocasia*) and *P. Jatrophae* (from *Jatropha Curcas*) are distinct species, differing from each other by their *habitus* in pure culture and by the form and dimension of the conidia. *P. Fagi* and *P. Cactorum* are quite different from the four species mentioned. *P. Jatrophae*, *P. Fagi* and *P. Cactorum* formed oospores in pure culture; those of *P. Jatrophae* were not of the *Cactorum* type, but of the *infantum* type.

V. — The result of 390 infections with the six *Phytophthora* species on different hosts confirmed the result of the morphological investigation.

The *Phytophthoras* from Hevea, Cacao and nutmeg belong to the same species; only the line isolated from Cacao proved to be more virulent for Cacao and Hevea, and the one isolated from nutmeg more virulent for nutmeg.

Infections with each of the named species are only successful on its own host. With *P. Jatrophae* no successful inoculations were obtained, not even on "djarak" (*Jatropha Curcas*) from which it was isolated.

VI. — As to the treatment of canker, preventive measures are and to

an, the most important ones ; first of all thinning out, next drainage and removal of intercrops. Pruning for the purpose is no longer practised.

The direct measures consist only in excision of the red canker patches and the dressing of the stripe-canker with Carbolineum Plantarum (20 % less). Detection of the disease at an early stage is highly important. Diseased trees are not tapped.

When done thoroughly this treatment proved a complete success in most cases ; on some estates, where the climate favoured canker, this treatment is not sufficient ; new means of combating the disease are to be looked for, probably spraying with a fungicide ; also the fruit-rot should receive more attention.

VII. — Infection experiments with fruit rot are briefly discussed. *Faberi* alone can cause fruit rot, and even without a wound being previously made. During the experiments the disease spread in a most extraordinary way. When starting the experiments there was not one diseased fruit in the plantation ; after three weeks the experiments had to be stopped because locally 50 % of the fruits were attacked, many of them being quite covered with *Phytophthora* conidia. Small flies (*Drosophila*) seem to help a good deal in spreading the disease.

VIII. — Four different kinds of burrs in Hevea-bark are distinguished according to their origin :

1) Real peas in leaf-scars. These are not caused by dormant buds, as the connection with the pith is still intact and therefore the bud alive. Probably these are formed around the remainder of the vascular bundles of the petiole (BATESON), as has been demonstrated by HARTIG for the phaceloblasts, which are formed in the leaf basis of fir-trees. These peas are rare and harmless.

2) Burrs arising after the use of the pricker ; these are built concentrically around the scars made by the pricker. These become rarer every year and will soon disappear wholly.

3) Burrs as a result of canker ; these are very common and often of considerable dimensions. Nearly all the badly burred trees are of this type. The only remedy is to prevent or treat all canker-cases.

4) In some case the burrs are not secondary wood-formations in the cortex, but the central wood itself has an irregular surface not only on the stem but on the branches also. The cause is unknown. The trees are worthless and should be removed.

95. — *Peronospora Radii*, a Parasite of Camomile, New to Italy. — BELOSEREV, N. In *Atti dell'Accademia Veneto-Trentino-Istropolitana*, Vol. X, pp. 111-116. Padova, 1917.

In May 1917, near Este (a district called "Dossi", in the parish of Sordello Euganeo, province of Padua), Prof. A. BÉGUINOT collected several specimens of *Matricaria Chamomilla* L., with deformed heads, growing in the sand of an old bed of the Adige.

The ligulate flowers were the worst attacked, which made a strange fact so that the first impression was that of a species differing from that commonly found. An examination of the purple matter covering the diseased

ed parts speedily showed the presence of conidiophores and conidia of *Peronospora Radii* De Bary.

The symptoms of the disease are described, and it is pointed out that this *Peronospora*, found for the first time in Germany and already observed in Belgium, Austria, Finland, Switzerland and France on camomile and other Compositae, had never previously been reported in Italy. Venice is one of the districts which have been most thoroughly studied from mycological point of view and 13 species of *Peronospora* have been found there. It therefore seems that *P. Radii* must be new to the district.

1096 - *Bacterium Pruni*, Injurious to Peach and Plum Trees in the United States

ROBERTS, JOHN, W., in *United States Department of Agriculture, Bulletin 543*, pp. 1-11. Washington, D. C., 1917.

In most of the peach-growing sections of the eastern half of the United States (Massachusetts, Connecticut, New Jersey, Delaware, Maryland, Pennsylvania, Michigan, Illinois, Indiana, Ohio, Kentucky, Tennessee, Virginia, North and South Carolina, Georgia, Alabama, Arkansas, Missouri, Nebraska and Texas), and especially in the most southern ones, a disease commonly called peach bacterial spot, or peach bacteriosis, is coming increasingly important.

The disease is caused by *Bacterium pruni* Erw. F. Smith, which attacks plum trees as well as peach trees.

The parasite attacks the leaves, fruit and twigs.

If there are a number of infections close together, they may coalesce forming a rather large canker, with a somewhat abundant flow of gum. As far as the peach is concerned, the direct killing of the twigs and branches is rare and this phase of the disease is not in itself to be considered as very serious; the twig lesions are, however, of importance, for it is in these that the pathogenetic organism passes the winter.

On the fruits, minute spots first appear, these soon become enlarged; later, small cracks appear in the diseased areas, these extend and finally several run together, making long irregular fissures which render the fruit unfit for market. Orchards in which direct damage to fruit causes no loss are, however, rather rare.

The injury to the leaves is usually the most serious phase of the disease. Small, nearly transparent, areas occur on the leaves; later, these spots become dry and brittle, then as a final stage, they crack away from the living tissue and often fall out, giving the leaf the so-called shot-appearance or else a peculiar ragged aspect. Sometimes the injury caused is so great that the tree is partially, or even totally, defoliated.

Practically all peach varieties are attacked, at least to some extent by this disease. The Elberta, the leading commercial peach, is very susceptible. It is very difficult to estimate the relative susceptibility of different varieties, but the Bilyew, Elberta, Carman, Champion, Oldmixon, Sun and Waddell appear to be more susceptible than such varieties as Hilly, Belle, Fox, Edgemont, Rivers, Early Crawford and Salway. *Bacterium pruni* especially attacks Japanese varieties of plum.

Experiments carried out by the writer, and others, indicate that this disease may be kept in check in southern peach orchards by proper pruning, cultivation, especially fertilisation. Nitrate of soda was by far the most efficient fertiliser used. Trees in which a high state of vigour and health is maintained are commercially resistant to the disease.

INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

1907 - **Animal Pests Observed During 1916 in Denmark.** — See No. 1084 of this Review.

1908 - **Undesirable Insects Which Have Recently Been Introduced into New Jersey United States.** — WEISS, HARRY, B., in *The Canadian Entomologist*, Vol. XLIX, No. 9, pp. 293-298, pl. XIV, London, 1917.

In order to show that ordinary phytopathological inspection on arrival is not sufficient to prevent plants coming from abroad being the means of introducing parasites destructive to the crops of a country, the writer mentions some recent cases which have occurred in New Jersey and have caused considerable loss to the farmers in that State.

He deals with a few of these cases in detail: *Gryllotalpa gryllotalpa* (the mole cricket) came to New Jersey in a rhododendron plant from Holland; *Blaberus discoidalis* (the large cockroach) was introduced with some wild orchids from South America; *Stephanitis pyrioides* came to New Jersey from Japan on an azalea; and *Cholus forbesii* was transported into that State on some orchids from the tropical forests of Colombia.

To remedy this state of affairs, the writer suggests the institution of a national quarantine of all foreign nursery stock.

1909 - **Observations on the Coccidae of Asia, Africa and America** (1). — NEWSTEAD ROBERT, in *Bulletin of Entomological Research*, Vol. VIII, Part. I, pp. 1-34, fig. 1-22, London, 1917.

A systematic description of:

1) *Ilavicia abrahami* sp. nov., inhabiting indentations in the bark of *Sapium jennmani* at Issororo, N. W. District (British Guiana); attended by ants which construct coverings over the Coccids;

2) *L. pruniviva* var. *pimentae* var. nov., on *Pimenta officinalis* in Jamaica, attended by the "stinking-ant" (*Crematogaster* sp.); not of great importance;

3) *Monophlebus* (?) *hirtus* Brauer, Mt. Mlanje (Nyasaland);

4) *Aspidoproctus newei* sp. nov., in the same locality on the "Mwange" tree;

(1) See also K. October 1917, No. 1171.

- 5) *A. ferrugosus* sp. nov., on the trunk of a fig tree, Ngamba Is.
Uganda;
- 6) *Palaeococcus bicolor* sp. nov., on *Thespesia* sp.; Aburi (Gold Coast)
- 7) *P. caudatus* sp. nov., on crotons (*Codiaeum*) at Entebbe (Uganda)
- 8) *P. Cajani* sp. nov., on *Cajanus indicus*, at Agege (S. Nigeria)
- 9) *Icerya nigroareolata* sp. nov., on coffee at Kampala and on *Codiaeum*
at Jinji (Uganda);
- 10) *I. sulfurca* var. *pattersoni* v. nov., on *Tectona* sp. at Aburi;
- 11) *Margarodes buxtoni* sp. nov., at El Kantora (Algeria);
- 12) *Stictococcus gowdeyi* Newst., on young shoots of cacao, at Agege
invariably protected by an ant (*Oecophylla*);
- 13) *St. intermedius* sp. nov., on cacao; Aburi;
- 14) *St. multispinosus* Newst., on stems of *Cajanus indicus* at Agege
and on *Markhamia platycalyx* at Kampala;
- 15) *Asterolecanium spectabile* sp. nov., on palm trees in Botanic Ga-
dens, Mauritius;
- 16) *Lecaniodiaspis tarsalis* sp. nov., at Pretoria (Union of South
Africa);
- 17) *Phenacoccus ballardi* sp. nov., on mango, at Coimbatore and
an unnamed plant in S. Kanara District (S. India);
- 18) *Tachardia bodkini* sp. nov., on *Sapium Jenmani* near Rejo
Georgetown (British Guiana);
- 19) *Pulvinaria aristolochiae* sp. nov., on *Aristolochia* sp. at Aburi;
- 20) *P. elongata* sp. nov., on blade of sugarcane at Georgetown;
- 21) *P. (?) flavicans* Mask., on "blood-wood" plant at Rockfort
(British Guiana);
- 22) *P. subterranea* sp. nov., on roots of *Chrysanthemum* at Entebbe;
- 23) *P. africana* sp. nov., heavy infestation on guava, at Accra (Gold
Coast); many examples of the scale-insect were attacked by a parasitic
fungus and by the larvae of a predaceous lepidopteron;
- 24) *Ceroplastes avicenniae* sp. nov., on *Avicennia nitida* at Mahabodhi
Creek (British Guiana);
- 25) *C. bipartitus* sp. nov., in Union of S. Africa;
- 26) *C. destructor* sp. nov. (*C. ceriferus* [Anderson] Newstead).
Uganda;
- 27) *C. egbarum* Kell., on *Pithecolobium saman* at Tamale (Gold Coast)
- 28) *C. lamborni* sp. nov., on cacao and on a climber on a bush at
Ibadan (Southern Nigeria);
- 29) *C. subnudatus* sp. nov., on *Acacia* sp. at Entebbe;
- 30) *C. vulleleti* Marchal, abundant on *Cajanus indicus* at Agege and
Ibadan;
- 31) *C. zonatus* sp. nov., in Union of South Africa;
- 32) *Inglisia theobromae* sp. nov., on stems of cacao pods and
flowers, at Nagunga (Uganda).

100 - **Coccidae of British Guiana.** — BODKIN, G. H., in *Bulletin of Entomological Research*, Vol. VIII, Part. I, pp. 103-109, London, 1917.

The present paper is supplementary to the one published in 1914 on the same subject (1).

It is necessary to mention the following scale-insects once more, as they have now been found upon different host plants from those recorded in the preceding paper:

- Howardia biclavis* Comst., fairly common on branches of *Jasmin* sp;
- Hemichionaspis minor* Mask., fairly common on *Asclepias* sp;
- Pseudococcus virgatus* Ckll., on some garden plants, such as *Viola*;
- Croplastes denudatus* Ckll., collected recently on a wild solanacea;
- Vinsonia stellifera* Westw., on orchids;
- Saissetia oleae* Bern., on *Codiaeum* spp;

The following species are recorded for the first time in the Colony:

Ilaceta abrahami Newst., a rare species, hitherto only found in an infestation of the bark of *Sapium jenmani*;

Aspidiotus rapax Comst., an uncommon species; up to the present only found on the twigs of the Oronoque tree (*Erythrina glauca*);

Pseudonidia jossor Newst., an uncommon species only once collected on the twigs and branches of a large Muscatel grape-vine in Georgetown;

Chrysomphalus erythrapsidis Newst., a comparatively rare species; collected once in abundance on the twigs of *Erythrina glauca*;

Pseudococcus sacchari Ckll., common wherever sugar-cane is grown in British Guiana; most prevalent in dry weather;

Tachardia bodkini Newst., rare; on twigs of *Sapium Jenmani*;

Pulvinaria flavicans Mask. var *formicicola* Newst., an uncommon species collected from wild species of plant with a deep red sap;

P. longata Newst., rare; collected on the leaf-blades of sugar-cane;

Croplastes cirripediformis Comst., an uncommon species occurring on *Ipomoea* sp. at Georgetown;

C. aricenniae Newst., an uncommon species, occurring solely on a marine plant known locally as "Courida" (*Aricennia nitida*);

Eucalymnatus chelonoides Newst., rare; collected on leaves of *Pachira* species in Botanic Gardens, Georgetown;

Enc. tessellatus Sign., a common species on ornamental palms;

Coccus aequalis Newst., common in certain districts on *Aricennia nitida*;

C. viridis Green, a common species on *Coffea liberica* in some districts of considerable economic importance;

C. grandis Newst., a rare species from leaves of Malacca apple (*Eugenia malaccensis*), Georgetown;

C. impar Ckll., uncommon species; name of host plant unknown;

Thermes quinquepori Newst., rare species; from beneath the bark of certain trees, e. g. *Macarobium acaciaefolium*, in Botanic Gardens, Georgetown.

Saissetia hurae Newst., a rare species; a thick infestation was, however, discovered on one occasion on the twigs of *Hura crepitans*;

S. scutata Newst., rare; a large colony was discovered in one instance on a cannon ball tree (*Couroupita guianensis*); the infestation covered the branches which bear fruit and flowers near the ground.

The following natural enemies have been observed in addition to those recorded in the last paper.

FUNGI. — *Cephalosporium lecanii* on *Coccus viridis*. When the weather is wet, *Pseudococcus sacchari* is subject to the attack of a green fungus which causes great mortality.

NEUROPTERA. — *Chrysopa claveri* Navas (fam. *Chrysopidae*) occasionally found attacking *Ps. sacchari*.

COLEOPTERA. — The *Coccinellidae* are among the most important enemies of scale-insects in the Colony. The following species have been observed and identified:

Pentilia insidiosa Muls., predaceous only on *Asterolecanium bambus*, Bdv.; it is a common species where this Coccid occurs;

Hyperaspis festiva Muls., commonly attacks *Ps. sacchari*;

Hyp. orthopusculata Muls., another common enemy of *Ps. sacchari*;

Brachyacantha 10-punctata Melsh., attacking a species of *Pseudococcus* an uncommon species;

Neda dilychnis Muls., predaceous on *Aspidiotus destructor* Sign., an uncommon species, but found in this one instance occurring in large number on a heavily infested coconut palm.

HYMENOPTERA. — The following parasites have been bred from Coccids at various times:

Arrhenophagus chionaspidis Auriv., obtained from *Hemichionaspis minor* Mark;

Leptomastix dactylopii Howard, from *Pseudococcus citri*, Risso;

Lecaniobius cockerelli Ashm., from *Saissetia nigra* Nietn.

The following species of ants have been observed to attend certain species of Coccidae:

Daceton armigerum Latr. found with *Ps. citri* on cacao pods;

Cryptocerus atratus L. with *Ps. citri*, *Coccus hesperidum* L., *Saissetia nigra*;

Crypt. minutus F. with *Pulvinaria pyrifformis* Ckll. and *Coccus hesperidum*;

Ectatoma tuberculatum Oliv. with *Saissetia nigra* on *Hibiscus esculentus*

Tetramorium guineense F. with *Ps. sacchari* on sugar-cane; and with *Ps. citri* on cacao pods;

Azteca schimperi Em. with *Lecanium aquale* Newst. and *Ceroplastes avicenniae* on *Avicennia nitida*;

Dolichoderus (Hypoclinea) with *Ps. citri* on cacao pods;

Solenopsis pylades Forel with *Ps. sacchari* Newst.;

Cremastogaster sp. with *Pulvinaria flavicans* var. *formicicola* Cocc. *aequalis*, *Akermes quinquepori*, *Saissetia hurae*, *S. scutata*.

1. - Observations on the Coccids, *Lecanium corni* and *Physokermes piceae*, in Wisconsin, United States. — FENROX, F. A., in *The Canadian Entomologist*, Vol. XLIX, No. 9, pp. 309-320, pl. XV-XVI, London 1917.

The investigations on the subject of *Lecanium corni* Bouché (European Fruit Lecanium) and *Physokermes piceae* Schr. (Spruce Scale) were made at Madison, in Wisconsin.

With regard to the first species, the writer not only touches upon history, geographical distribution and economic importance, but also enumerates the very numerous host plants of the insect. He also gives life-history and systematic description of this coccid, and then describes experiments carried out for the purpose of determining whether *Lec.* it can be transferred from one host plant to another. These experiments on a large number of cases gave negative results, but were not decisive.

Finally, the writer gives a list of the natural enemies (parasitic and dactylos insects, fungi) of this *Lecanium*.

The writer gives the history of *Phys. piceae*, speaks of its distribution in America (on *Picea* spp. and *Pinus Strobus*), describes its life-history, and concludes with a systematic description of this coccid and a list of its natural enemies.

2. - Cotton Plants as Green Manure: a Method of Controlling the Mite *Eriophyes gossypii* and the Scale Insect *Saissetia nigra* in the Island of St. Kitts, Lesser Antilles. — SHEPHERD, F. R., in *The Agricultural Journal of India*, Vol. XII, Part I, pp. 120-121, Calcutta, 1917.

On account of the numerous animal enemies attacking the cotton plant, such as the leaf-blister mite (*Eriophyes gossypii* Bks.) and the black scale (*Saissetia nigra* Niet.) it was formerly the custom, especially where successive cotton crops were grown, to burn the cotton plants, in order to exterminate the above mentioned parasites. The plants were generally pulled and burnt about a month before the new crop was sown.

In the Island of St. Kitts, where cotton is only grown on the same plot at intervals of about 2 or 3 years, the plant has always been used as a green manure instead of being burnt, for it was believed that the parasites did not remain alive so long.

In the experiment plots of La Guérite, the cotton plants were always pulled up and burnt until the last two years, when they were employed as a green manure. This practice was adopted after it was found that a neighbouring field, where some old plants infested with *Er. gossypii* had been dug in before sowing the next crop, the new cotton plants were especially attacked by this mite.

At La Guérite, for the last two years, cotton plants have been used as green manure about six weeks before the new sowings were made. It is necessary to pull up the cotton plants carefully, and not to cut them level with the soil, because in the latter case the old stock is apt to throw up shoots in which the mite still remains.

It is advisable, when possible, to dig in the cotton plants from at least six weeks to 2 months before resowing, in order to give the old plants time to decompose, and also for the purpose of decreasing the risk of harm to

the seed due to incomplete fermentation. Further, there is then less fear that the mite should be alive when the cotton crop is again sown.

1103 — **Animal Pests of wheat, in the Argentine.** — See No. 1016 of this Review.

1104 — ***Blitophaga opaca*, a Coleopteron Injurious to Barley, Beets and Potatoes in the Scandinavian Peninsula** (1) — KEMNER, N. A., in *Kungl. Landbruks-Akademiens Handlingar og Tidskrift*, Year 1917, No. 5, pp. 446-449, figs. 1-2, Stockholm, 1917.

Blitophaga opaca L. ("Gulhåriga Skinnarbaggen") hibernates under stones, among dry leaves and moss, and only emerges in late spring.

Copulation takes place in June. The eggs are laid in the soil and the larvae emerge towards the beginning of July (in Norbotten). Three weeks later, they pupate in the soil. The adult insect appears after 14 or 15 days.

The insect, both in the larval and adult stage, attacks the leaves of many cultivated plants.

It appeared in Sweden for the first time in 1889 in the Klöv-jö barley fields (Jämtland district), and spread rapidly towards the north as far as Norbotten, as well as to the districts bordering on Norway and Finland.

Besides barley, *B. opaca* also attacks other crops, for example, potatoes (in Norway), sugar beets and mangolds (in Skåne, Östergötland, Öland, Halland).

Excluding the host-plant temporarily (for two or three years) from the field has no effect on the insect, because, owing to its capacity of adaptation, it immediately attacks other plants.

Possible methods of control are: 1) arsenical spraying of the larvae; 2) soil cultivation during the pupal stage.

In the same district, on the same plants, two other harmful coleopterans are found: — *Phosphuga atrata* L. ("Svarta Skinnerbaggen") and *Thalophilus lapponicus* Herbst ("Lappska Skinnerbaggen").

1105 — ***Sitona lineata*, a Coleopteron Injurious to Leguminosae in Sweden** — KEMNER, N. A., in *Kungl. Landbruks-Akademiens Handlingar og Tidskrift*, Year 1917, No. 5, pp. 450-453, figs. 1-5, Stockholm, 1917.

The adults of *Sitona lineata* L. emerge in spring from their winter shelters and spread over leguminous plants (especially clover), attacking and destroying the young leaves and terminal buds. Copulation takes place early in summer, and the females lay their eggs on or near the surface of the soil. The larvae greedily attack the roots, especially the tubers and rootlets, sometimes leaving only the thin outer wall.

In Sweden this insect is common in districts where leguminous crops are grown and is found as far north as 61° in the Dalarna districts.

In spring, arsenical sprays might be used against the adult, but, in serious cases, the best method is not to grow leguminous plants for a certain number of years.

(1) See also *R.*, May 1916, No. 565, and No. 1084 of this Review under the synonym *Silpha opaca*. (Ed.)

(2) See also *B.*, Nov., 1911, No. 1076 and *R.*, July, 1916, No. 821. (Ed.)

- 1106 - *Meligethes aeneus*, a Coleopteron Injurious to Cruciferae in Sweden (1).
— KAMMER, N. A. in *Kungl. Lantbruks-Akademiens Handlingar* or *Tidskrift*, Year 1917,
No. 5, pp. 454-457, figs. 1-3. Stockholm, 1917.

The adults of *Meligethes aeneus* appear in small numbers in the spring in fields in flower and on fruit trees. Late in the season they attack turnips, cabbages and mustard in large numbers, damaging the tender parts of the plant, with a preference for the inflorescences, thus reducing the seed yield very considerably.

After copulation the eggs are laid in the buds and inflorescences, and the larvae complete the work of the adults by destroying the flowers and leaves.

The larval stage lasts two or three weeks. The pupae are found in the soil at a depth of about 10 cm., and the adults emerge after 12 to 14 days.

This insect is very common in Skåne as far as Norrland, and also in Götland, where, in 1892-1895, it almost completely destroyed the seed turnips.

Arsenical treatment is not to be recommended: 1) on account of the cost; 2) because, with arsenic salts, the pollen loses its germinating power; 3) because the insects, hidden among the leaves and flowers, easily escape the action of the poison.

- 1107 - Insects Injurious to the Cacao Plant in the Belgian Congo and Natal. — ARROW: GILBERT, J., MARSHALL GUY, A. K., CAHAN, C. L. and DISTANT W. L., in *Bulletin of Entomological Research*, Vol. VIII, Part 1, pp. 111-118, figs. 1-3. London, 1917.

Amongst the material recently collected by Mr. RAYMOND MAYNE, Government Entomologist of the Belgian Congo, for making a special study of the insects living at the expense of the cacao plant in this region, there occur the following species which were observed in the district of Mayumbe. The writers give a systematic description of these parasites.

A) COLEOPTERA:

a) fam. *Melolonthidae* (determinations made by G. J. ARROW):

1) *Asatica variegata* sp. nov., which destroys the young and tender leaves of the cacao plant; 2) *Pseudotrochilus concolor* Kolbe; 3) *Triodontia procera* Lausb.

b) fam. *Curculionidae* (determinations made by G. A. K. MARSHALL):

1) *Systates ramosus*, sp. nov., which when adult attacks the foliage of fully developed plants; this species, however, is rare; 2) *S. Maynei* sp. nov., very abundant in the cacao plantations, where it is especially harmful to young plants in the nurseries. The injury is caused by the adult insect which eats large pieces of the margins of the leaves; 3) *Alcidus theobromae* sp. nov., the larvae of this insect excavate longitudinal galleries in the small branches of the cacao plant; the leaves subsequently turn yellow, and the branches die; the individuals of *Alcidus theobromae* are, so far, not numerous enough to constitute a serious danger to cacao-growing.

(1) See also R. July 1916, No. 874, and *this Review*, No. 1085.

c) fam. *Lamiidae* (determinations made by C. J. Gahan): 1) *Tragocephala maynei*, sp. nov.; 2) *Exocentrus ortmansi*, sp. nov.

B) RHYNCHOTES:

fam. *Coreidae* (determination by W. L. Distant): *Pendulinus devastans* sp. nov.

Thanks to the last-mentioned writer, a description is added of another species, nearly related to the preceding one (*P. nigromarginalis*), which was found near Durban (Natal) and is probably also an insect injurious to crops.

1108 - **Mites Attacking Orchard and Field Crops in Utah, United States.** — DOANE R. W., in *Science*, New Series, Vol. XLVI, No. 1182, p. 102, Lancaster, Pa., 1917.

During the summers of 1915 and 1916, certain mites were found to be particularly abundant and destructive to grain in Utah.

The most important of these was the common *Tetranychus bimaculatus* Harvey, which EWING believes to be the same as *T. telarius* Linn., which, as has already been pointed out, is an important pest on a surprisingly large number of crops. In 1916, it was so abundant in orchards that many cherry trees were completely defoliated before the end of August, and apricot, pear, plum and apple trees were only a little less seriously affected.

Raspberry and currant bushes suffered severely, some of them losing all their leaves.

Peas, beans, tomatoes and other kinds of kitchen-garden produce showed more or less injury in all stages of their development. In one field of sugar beets, the writer found many leaves drying and turning brown on account of the attacks of this mite.

The loss of the foliage of many ornamental plants, while not of so much economic importance, was very annoying.

Maize probably suffered more than any other field crop. In many fields practically every plant suffered the loss of some of its leaves, and in other places all the leaves turned brown and became thoroughly dry because of the presence of myriads of mites on their lower surfaces. The parts of the fields where the soil was lighter and drier usually suffered most, but no parts seemed to be immune from the attacks of this pest. The suckers and lower leaves were the first to be attacked and to show brown spots or streaks. When the trouble went no further it was of but little economic importance, but when the upper leaves were attacked and practically all destroyed, the plant withered and was not even good for fodder.

Many wheat fields also sustained considerable losses due to the attacks of the same mite. The wheat plants would be usually attacked a short time before the head burst from the sheath, and when the infestation was bad, the leaves would become dry and brown at the point of attack and the portion of the leaf beyond this would droop and dry out. Often all the leaves were affected in this way, and the heads, if they developed at all, were small and poorly filled.

Earlier in the season, while the wheat plants were much smaller, they were often attacked by two other species of mite. One of these is the well-

known clover mite, *Bryobia pratensis*, while the other, which is known as the jumping mite, was first named *Tetranychus longipes* by BANKS who now places it with two others in a new genus, *Tetranobia*.

In fields where *T. longipes* is abundant, the leaves turn distinctly grey, and many of them become so dry, that the growth of the plant is seriously affected.

Both *B. pratensis* and *Tetranobia longipes* were found destructively abundant not only on wheat, but on barley, oats, and many wild grasses.

1109. **Two New Dipterous Cambium Miners.** — GREENE, C. T., in the *Journal of Agricultural Research*, Vol. X, No. 6, pp. 313-318, pl. 48, Washington, D. C., August 6, 1917.

This paper gives a systematic description of two new species of diptera, *Agromyza aceris* and *A. amelanchieris*, which mine in the cambium of living trees.

Agromyza aceris was found in the trunk and roots of red maple (*Acer rubrum*) at Falls Church, Virginia and at French Creek, West Virginia.

A. amelanchieris was found in the trunk and roots of the service berry, or shad-bush (*Amelanchier canadensis*) at French Creek. Nearly full-grown larvae were also collected at Smoky Mountain Crest, on the boundary line of Tennessee and North Carolina.